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Vol. CXXVIII. No. 3295 JANUARY 17, 1941 SIXPENCE

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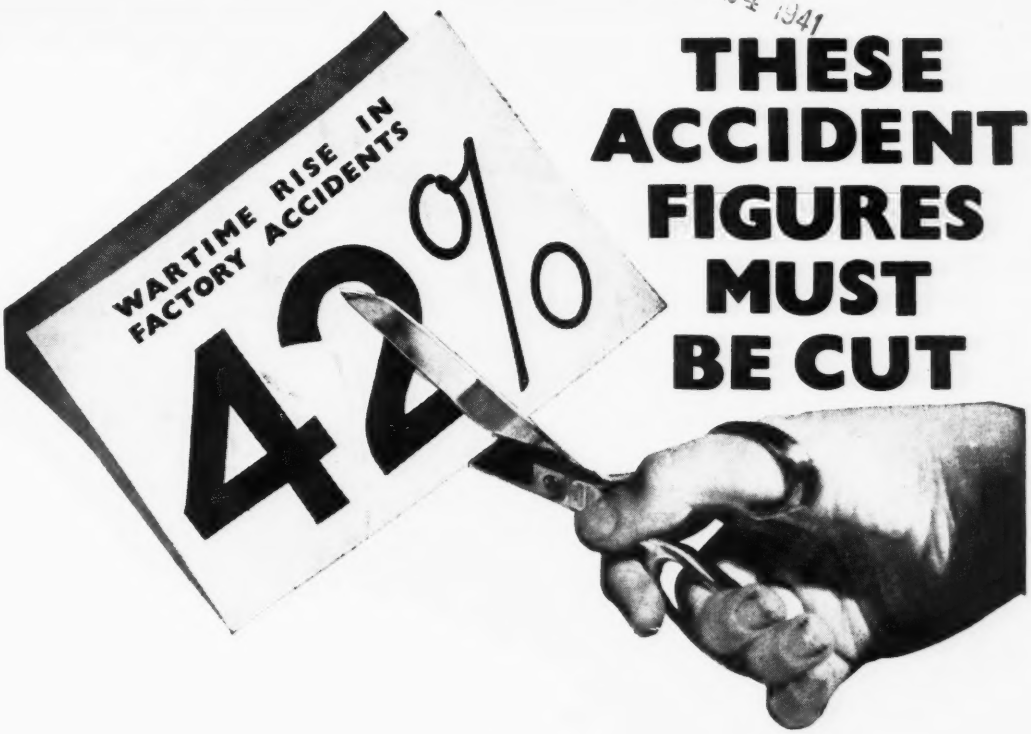

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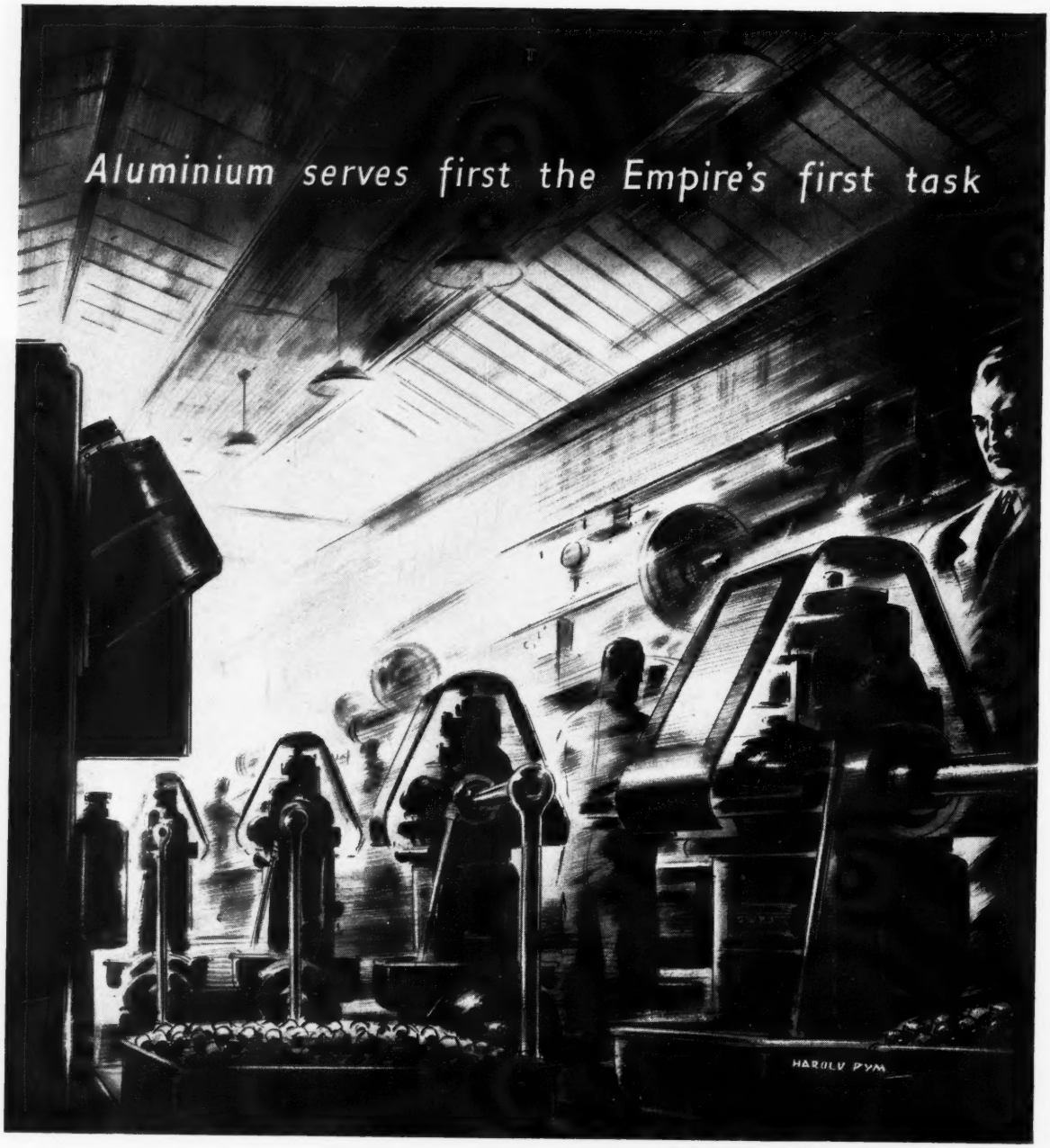

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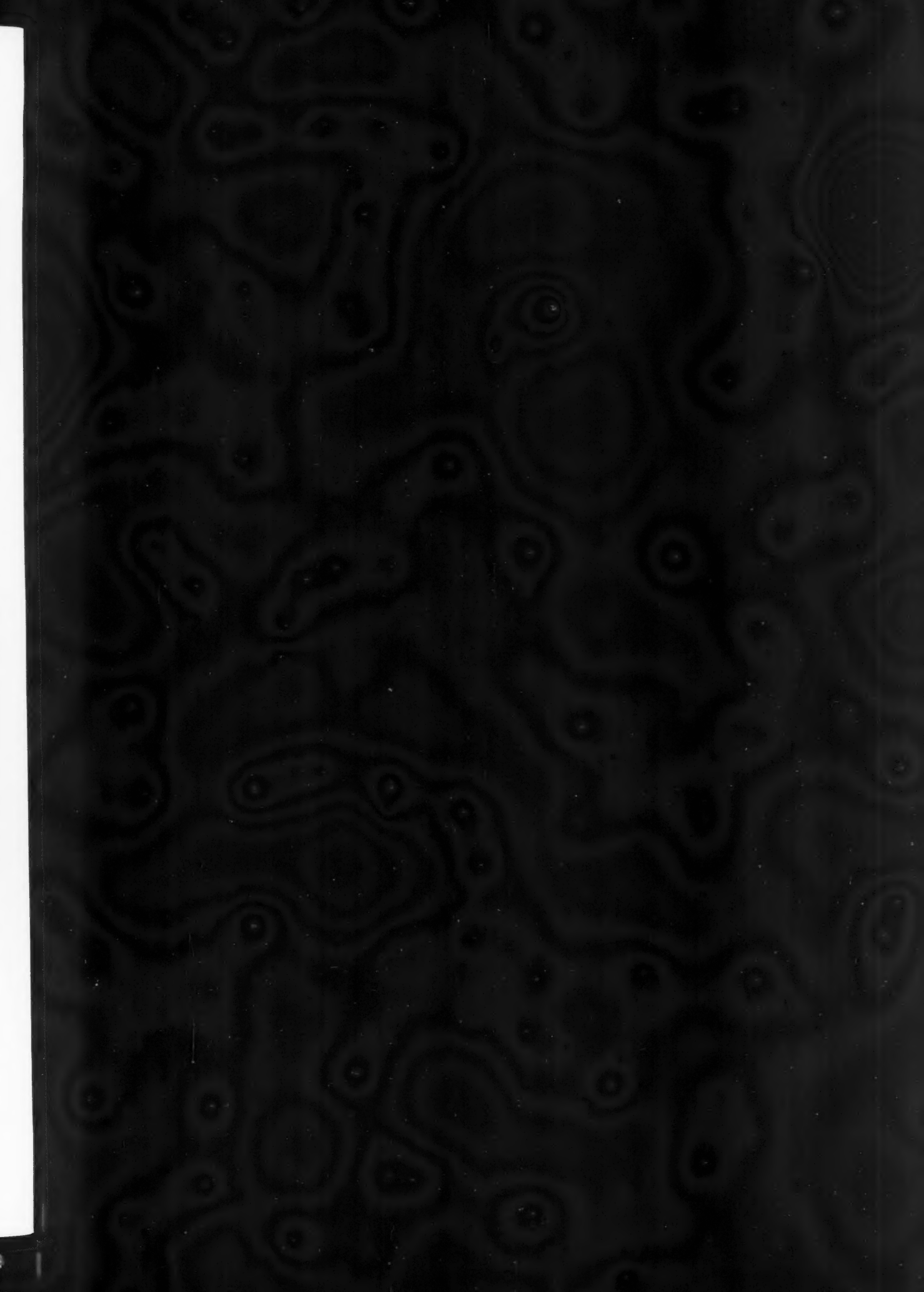

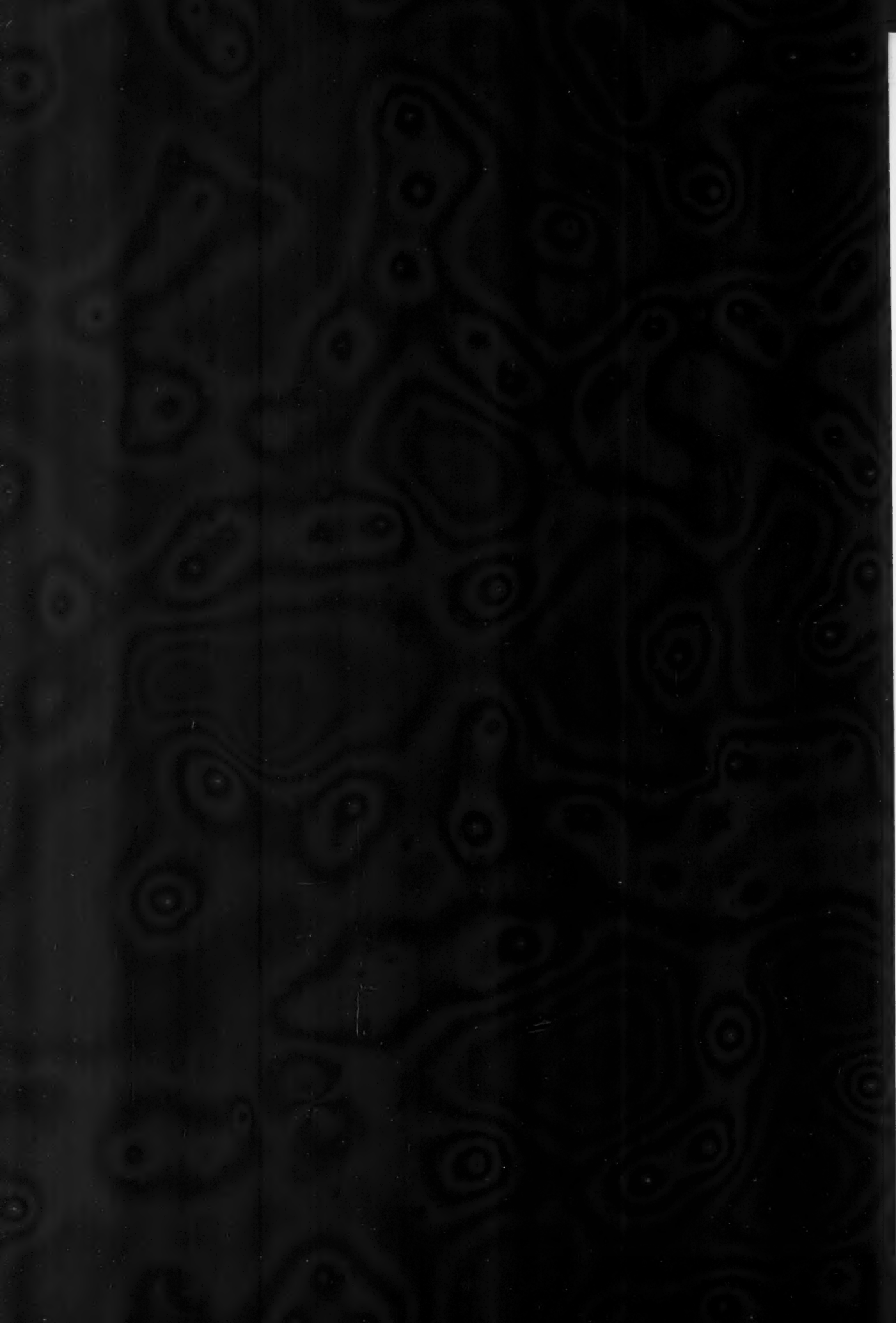

THE ELECTRICAL REVIEW

Volume CXXVIII **No. 3295**

Friday, January 17th, 1941

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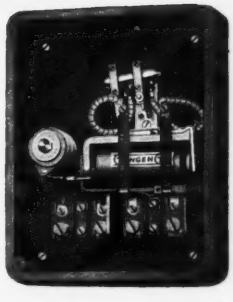

Fig. 1393 SELF-RESTORING RELAY

Fig. 365 TOUCHTONE HORN

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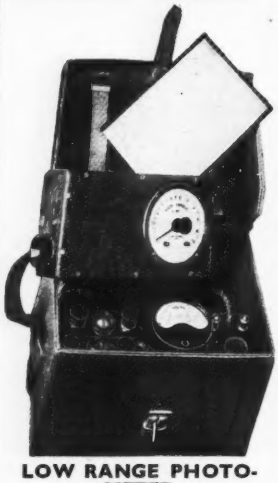

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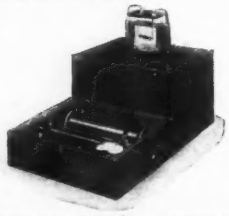

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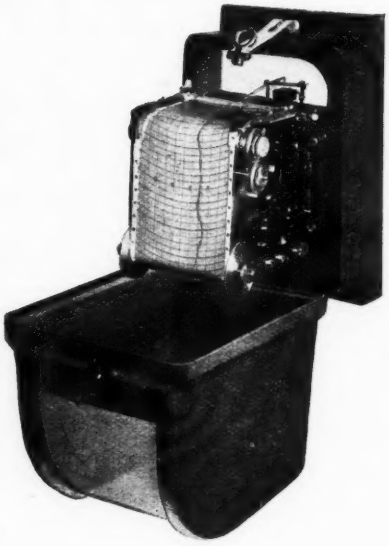

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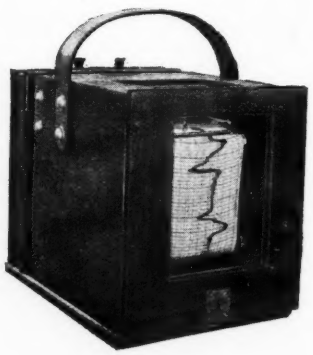

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Vol. CXXVIII. No. 3295 JANUARY 17, 1941 Price SIXPENCE

Instrument Progress

Variety and Reliability

THERE are many good reasons why the electrical way is the best and cheapest way of doing so many things. No other means of evaluation, however shrewd, can be so certain; for the facility and precision of electrical measurement are not only directly applicable in many ways, but can also be the indirect means of recording other quantities, down to such infinitely small movements as muscular reactions, or nerve and brain stimuli.

Accuracy, range and convenience characterise electrical instruments, which can be constructed and operated with ease and exactitude for detecting currents of almost any magnitude, even as small as one-million-millionth of an ampere. It is these features that make electricity so useful a medium for registration purposes; indeed, the comparison of electrical quantities, particularly electrical resistance, is possible over a large range with a greater degree of accuracy than that of any other physical property.

Most electrical instruments may be said to consist of three main mechanisms, or forces, which respectively exercise operating, controlling, or damping functions; so that practically any one of the various heating, electrostatic, chemical, or magnetic effects of electricity may be made to serve as the operative force of a measuring device. Consequently the products of the instrument section of the electrical industry are of a remarkable variety.

Standard Specifications

Such diversity is indicative of progressiveness promoted by sensible design and sustained by traditional reliability, based on constructional precision, which is the pride of senior members of the craft. Progress made in the design, or rather performance, of instruments is reflected in successive revisions of relevant British Standard Specifications, Mr. J. F. Stanley's useful review of these on another page, is a task that does not seem to have been attempted before. Mr. Stanley interprets the abandonment three years ago of the lowest of the three original grades of indicating and recording instruments as evidence of a general desire not to accept a lesser degree of accuracy for some purposes than for others. It also proves that first-grade instruments can be produced at prices which do not offer any inducement to purchase second-grade varieties.

One of the latest developments is the easement of the stipulations applying to instruments fitted with substitute bearings, which has been rendered necessary by the wartime shortage of jewels. The effect has been to increase, temporarily only, by 100 per cent. the normally permissible limits of error of first-class ammeters, voltmeters and wattmeters. Appropriate distinguishing markings have been standardised, while the practicability of re-using reclaimed component parts and substitute materials has already received some consideration.

Miniature Types

Topical in the present circumstances, but not new, is the plea made by the chairman of the Meter and Instrument Section of the Institution of Electrical Engineers for the use of the miniature type of indicating instruments on switchboards, and also for the standardisation of scales. That adaptability is the only safeguard against changing circumstances is well demonstrated by the appearance within the last very few years of so large a range of electrically-actuated aircraft instruments.

Of most topical interest perhaps just now is the subject of selective protection of transmission systems. It is not a secret, on the one hand, that war conditions have caused an increase in the number of faults on both overhead lines and underground cables. On the other hand, the fact is that the number of interruptions of supply has been very small. This seeming inconsistency is attributed to a large extent to the excellent performance of discriminative protective gear. Incidentally, the information contributed by Mr. C. W. Marshall with regard to transient measurements in relation to line-fault finding may not generally be known. In amplification of this Mr. W. T. J. Atkins outlines the latest method which he has devised for

ascertaining the positions of earth faults by recording the neutral currents during the faults at the two ends of the faulty sections of the lines.

Wartime Meter Practice

MR. S. H. Richards' survey of meter certification in wartime indicates a new appreciation of values. The creation of incentive has caused a new pride to be taken in this work, which induces the Chief Meter Examiner to visualise a growing desire to attain to still better efficiency without adding to the cost. The importance of accuracy in the commercial measurement of electrical energy has become predominant, which Mr. Richards points out means that " bench " accuracy for certification has improved by more than 50 per cent. in a little over two years. Similarly greater care is being devoted to the care and use of the standard and sub-standard apparatus with which the testing of meters is carried out. The splendid opportunities already gained must not be lost because of wartime relaxation. The watt-hour meter is a highly standardised article, designed to fulfil a particular function. There are available at the present time not fewer than sixteen British makes which experience suggests (according to Mr. R. N. Gregor, secretary of the Electricity Meter Manufacturers' Export Group) adequately cater for the requirements of the world's markets.

Industrial Safety

Even in peacetime the term " safety first " connoted an ultra-cautious attitude which crabbed the adventurous spirit and retarded progress. In wartime, while all reasonable precautions are justified, the expression is entirely opposed to the general feeling of the nation. It was this consideration which has led the National " Safety First " Association to alter its name to the Royal Society for the Prevention of Accidents, a title which incidentally indicates much more clearly the object of the organisation. In these days the need for such a body is more clamant than ever, since industrial establishments are taking in more and more new workers unaware of the dangers which beset them and more prone than older hands to take foolish risks, which is neither good for themselves nor for the industry which they serve.

Jointing in the " Blitz "

BECAUSE electricity usually goes on functioning smoothly during and after air raids there is a tendency to overlook the magnificent work of the men who make this possible, as was done in a recent broadcast by the Minister of Labour. It was a good idea of the B.B.C. to get Col. A. S. Angwin (Engineer-in-Chief, G.P.O.) to give subscribers some idea of the cost in human effort of keeping the telephone service going in these days (and nights). In some streets there may be as many as 100 cables, the largest of which contain perhaps 1,400 pairs in which 5,600 connections have to be made and tested for continuity in order to reconnect individual users to the exchange. Moreover, as the paper on each conductor must be entirely dry, in the event of flooding it is often a race against time—all this in cramped conditions, sometimes in danger of bombs, gas, water and sewage. Yet the time taken in jointing, Col. Angwin said, has been reduced from a peacetime average of 72 hours to 48 hours. Power cables are less complicated than telephone cables in some respects, but they bring their own problems. Col. Angwin's tribute was in a similar vein to that recently broadcast by Mr, J. C. Dalton (County of London Co.), who gave some idea of the way in which our industries are kept supplied with power and our homes with current for cooking and heating, now of all times when it is most essential that the supply should not fail.

Fluorescent Lamps

ALTHOUGH the chief claim for the 80-W tubular fluorescent mercury-discharge lamp is that its light is close enough to daylight for correct colour discrimination it has several other merits which give it a much wider scope. In the first place, its light output is approximately equivalent to that of a 200-W tungsten filament lamp and it is much less sensitive to voltage variations. Relative freedom from shadow, absence of glare due to the low surface brightness of the tube, and the reduced heat radiation give it further advantages over the tungsten lamp, while its aptitude for immediate starting and less noticeable stereoscopic effect, due to the afterglow of the fluorescent powder, make it more suitable for industrial purposes than most other types of discharge lamp. This would be enough of itself to justify the issue of the new (third) edition of " Modern Factory Lighting," the E.D.A.-E.L.M.A. publication, which gives particulars of the lamp which has been introduced since the appearance of the first edition in February last year. In this the opportunity has been taken to include minor revisions and references to British Standard Specifications, thus bringing the work thoroughly up to date and enhancing its value as a guide to all those who are interested in industrial illumination.

Absence from Work

A recent case in which an automatic machine tool setter was heavily fined for absenting himself from work without reasonable cause raises some interesting points. It would appear that the emergency powers conferred upon the Minister of Labour, although wide, do not cover such contingencies as this, for the summons was brought under the Employers' and Workmen's Act, 1875, and took the form of a claim for damages. In normal times such a case as this would be met by the dismissal of the recalcitrant employee, but the demand for skilled men is now so great that replacement is a matter of great difficulty. Consequently, apart from the effect upon the production of essential supplies, employers suffer real loss if " key " men are at liberty to please themselves whether they work or not.

A Strange Inversion

IT is quite common nowadays to find electric fires being used for cooking purposes, but it has been left to the daily Press to discover an inversion of this arrangement. The papers report that it was found difficult to secure electric radiators for a new seaside dance hall and so two dozen electric cookers were bought, the doors were taken off and thus a heating system was provided. No doubt in due course the proprietors of the hall (who happen to be the local Council) will be complaining of the high cost of electric heating.

A Standardising Laboratory

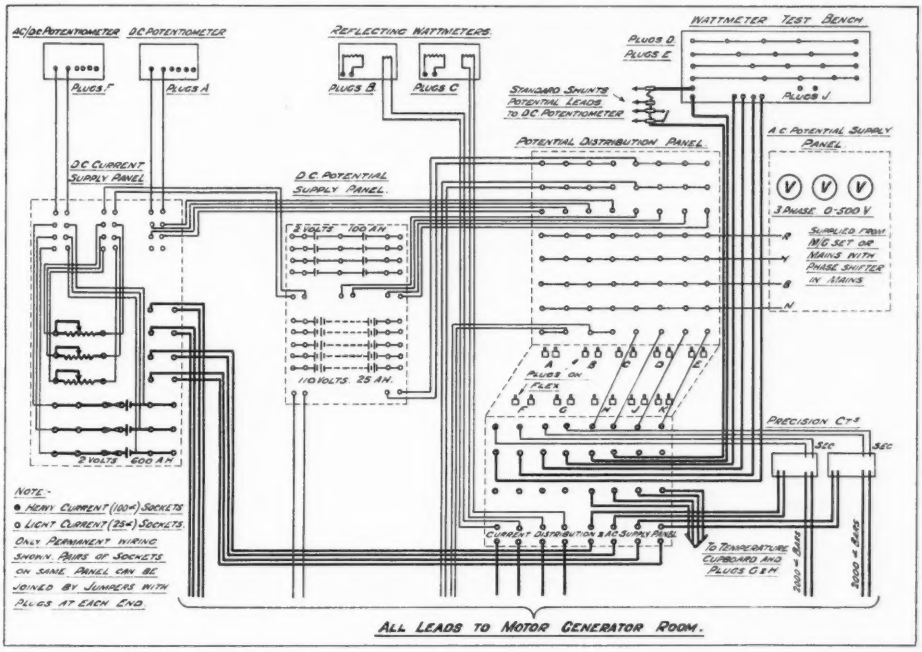
Steps Taken to Meet Requirements of the Meters Act

THE standardising equipment in the meter department of the Sheffield Corporation Electricity Department which was in use when the Electricity Supply (Meters) Act, 1936, was passed did not fully comply with the requirements of the Act, although a standard voltage cell, a DC/AC potentiometer and Drysdale & Duddell-Mather standard wattmeters comprised the essential part of the laboratory installation. Since the Meters Act did not

An outstanding feature of the new installation for standardising the meter-testing equipment of the Sheffield electricity undertaking is the use of very long scale reflecting wattmeters

accuracy of the rotating substandards would be inferior to that of the substandard wattmeters if the substandard wattmeters were to be utilised as calibration standards for determining the errors of the rotating substandards. The importance of having a perfectly steady source of AC supply for AC standardising was also evident, but the fact that the laboratory was already equipped with a battery-driven motor-alternator set relieved the position in this respect.

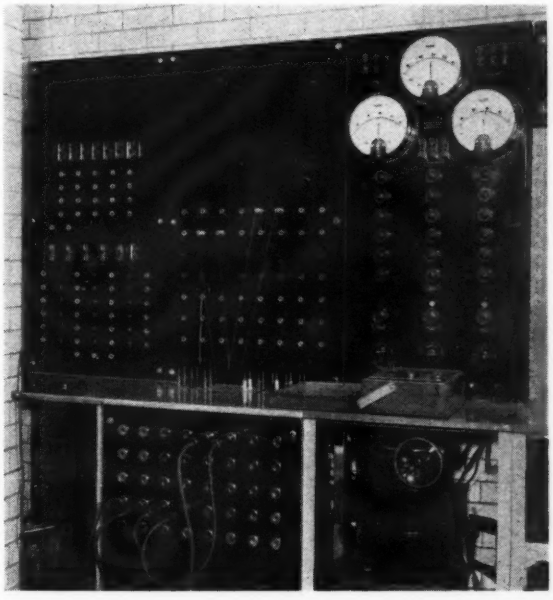
It was decided, therefore, to adopt the principle of using precision AC wattmeters as the standards against which all the substandard wattmeters and rotating substandards would be checked, this being the procedure adopted at the National Physical Laboratory. The Meters Act dictates that such standard AC wattmeters must be checked against a standard voltage cell, using a DC potentiometer. It follows that the differences of calibration for the AC wattmeters for their use on both DC and AC must be known accurately, and this point was one of the reasons for the choice


AC/DC POTENTIOMETER
DC POTENTIOMETER
REFLECTING WATTMETERS
WATTMETER TEST BENCH
PLUGS F
PLUGS A
PLUGS B
PLUGS C
PLUGS D
PLUGS E
PLUGS J
STANDARD SHUNTS
POTENTIAL LEADS TO DC POTENTIOMETER
POTENTIAL DISTRIBUTION PANEL
A.C. POTENTIAL SUPPLY PANEL
D.C. CURRENT SUPPLY PANEL
D.C. POTENTIAL SUPPLY PANEL
3 PHASE 0-500 V
SUPPLIED FROM M/G SET OR MAINS WITH PHASE SHIFTER IN MAINS
5 VOLTS 100 A.H.
110 VOLTS 25 A.H.
PLUGS ON FLEX
PRECISION C.T.s
2 VOLTS 600 A.H.
NOTE:-
HEAVY CURRENT (100A) SOCKETS
LIGHT CURRENT (25A) SOCKETS
ONLY PERMANENT WIRING SHOWN. PAIRS OF SOCKETS ON SAME PANEL CAN BE JOINED BY JUMPERS WITH PLUGS AT EACH END
CURRENT DISTRIBUTION & AC SUPPLY PANEL
To TEMPERATURE CUPBOARD AND PLUGS G & H
ALL LEADS TO MOTOR GENERATOR ROOM.

Schematic diagram of laboratory panel and instrument circuits. Right: Termination at plug panels of all instruments and supply circuits and interconnectors permits maximum flexibility; voltage plugs at top and current plugs at bottom

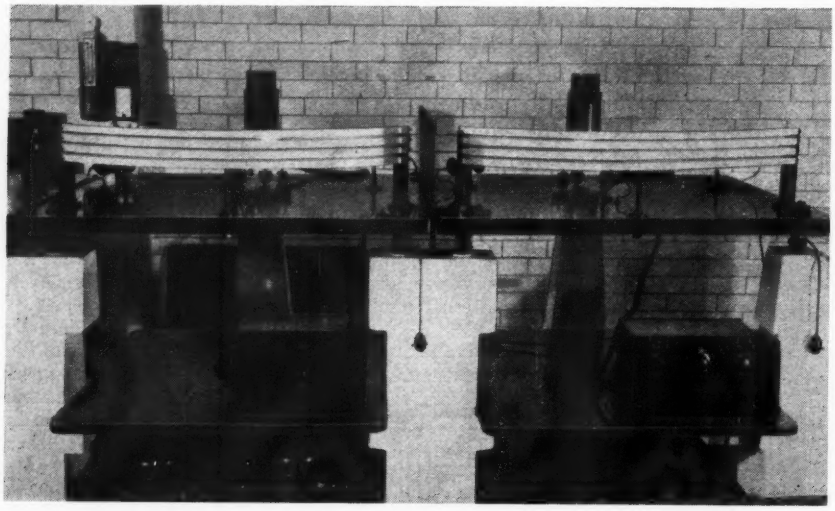
profess to make *complete* recommendations as to the apparatus required for standardising meter-testing equipment, but was designed more to ensure that all meter-testing standardising equipment did not fall below a desired standard of working proficiency, it was decided to re-equip the whole laboratory up to a standard commensurate with the importance of the undertaking. In its present stage of completion the re-equipped laboratory may be regarded as the first step towards a comprehensive project for the reorganisation of the Meter Testing Department as a whole.

A guiding influence in drawing up the laboratory scheme was recognition of the facts (1) that the AC calibration accuracy of deflection-type substandard dynamometer wattmeters, as used for kWh meter calibration, could be more closely determined if the tests were carried out on AC instead of DC; and (2) that if six-inch substandard wattmeters and rotating substandard integrating kWh meters were both to be employed as calibration substandards in accordance with methods C and B respectively of the "Approved Methods of Testing," then the calibration



of the standard instruments adopted for the laboratory.

As the Meters Act did not at that date provide for this method of standardising, the Electricity Commissioners' approval of both the standardising method and the use of reflecting wattmeters was obtained, a specification covering wattmeters of this type, together with Regulations detailing the method of use of such instruments for the purpose of testing substandard apparatus, being issued later.



A separate illumination system is employed for each of the scale sections of the reflecting wattmeters; note mirror galvanometer above and range boxes below

The generally accepted principles of modern laboratory lay-out have been adhered to, and white tiled walls, a clean hardwood block floor, automatically controlled air conditioning, total absence of normal extraneous noise, under-floor circuit wiring and ample glass-cupboard storage accommodation for portable instruments all contributed to our impression of a really well-designed installation. All the instrument leads, supply circuits from AC machines and mains, DC runs from batteries and generators and interconnectors between the various equipments are terminated at plug panels, an arrangement which permits the maximum flexibility with regard to interchecking between equipments as well as saving a great deal of time.

The ranges of the reflecting wattmeters are extended by two precision multi-range current transformers

A standard voltage cell, used in conjunction with a DC vernier potentiometer having a range up to 1.9 V in steps of 0.00001 V, with a 1/10th range switch, and a voltage multiplier box and standard shunts forms the basis of measurement and is used for the direct calibration of dynamometer and moving-coil ammeters and voltmeters and two reflecting watt-meters produced by the Cambridge Instrument Co., Ltd.

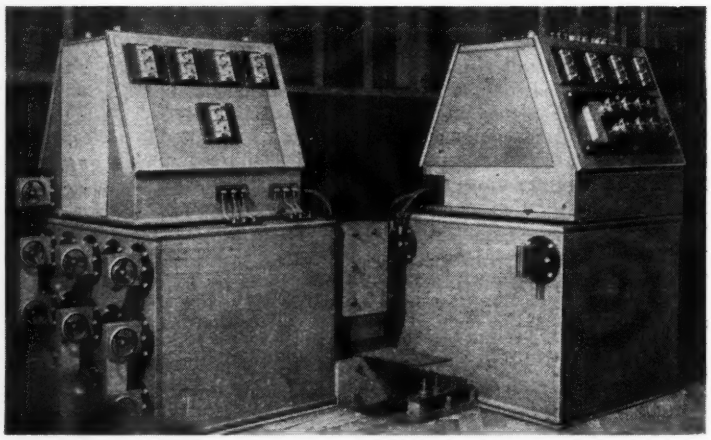
These wattmeters are used as the transfer standards for the AC calibration of deflection-type substandard wattmeters and rotating substandard watt-hour meters and are mounted on heavy slate bases upon which are also mounted the lamps and scales.

The scales are each arranged in three sections in horizontal tier formation, a separate illumination system being employed for each scale section. As the hair-line image of the wattmeter mirror indicates the maximum reading on the first (top) scale section, the illumination system for the intermediate-reading (middle) scale section indicates the minimum reading on this section. This performance is repeated in the relative operations of the second and

Data Relating to Reflecting-wattmeter Equipment

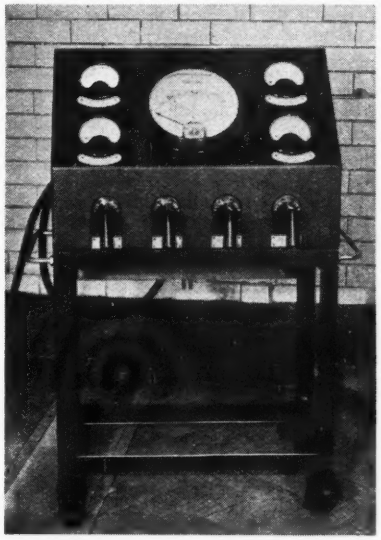
TABLE A

Current Ranges (range box)		Voltage Ranges (range box)		Full-scale reading in W on 5-A 100-V range		Period undamped	Accuracy of Instrument	Temperature Coefficient	Error on zero p.f.	Scale length	Error compensating switch range	Frequency range switch cycles per sec.
Amperes Normal	Amperes Maximum	Normal	Maximum	High p.f.	Low p.f.							
0.5	0.75	50	75						Less than 0.05			
		100	150	Nominal	Nominal			Less than	per cent.			25
1.0	1.5	200	300	500	100			minus	of VA			50
		250	375			5 secs.	0.05 per cent.	0.005	loading at	2.5 m	± 0.25 per	75
2.5	3.75	300	450	Actual	Actual		above ‡	per cent.	frequencies	readable	cent. in steps	100
		400	600	650	130		of full	per deg.	between	to	of ± 0.05	
5.0	7.5	500	750				scale.	C rise.	25 and 100	0.125 mm	per cent.	



third (bottom) scale sections. The total graduated length of the complete scale is 2.5 metres, equivalent to eight feet.

A feature of each of the reflecting-wattmeter equipments is the range box, which not only enables the various voltage and current ranges detailed in Table A to be selected by the turn of a switch, but also embodies a reversing switch, frequency range selector switch, deflection multiplier switch (× 5) for low power-factor measurement, and a self-compensating error switch scaled in steps of ± 0.05 per cent. of the indication. The normal current ranges are 0.5, 1.0, 2.5 and 5 A, and there are seven voltage ranges from 50 V to 500 V, inclusively. Each instrument has 28 ranges for measuring nominal full-scale deflections at loadings from 25 W to 2,500 W, and the rotary selector switches for range changing can be operated on load. The external circuits of the wattmeters are taken to the transfer plug panels which permit connection with the DC and AC potentiometers, with the wattmeter test bench and for three-phase power measurement, either by direct connection or with the instrument ranges extended by either of the two precision multi-range current transformers.



The battery-driven motor-alternator set is controlled from a portable control desk in the laboratory

These Arnold-pattern Everett Edgecumbe current transformers have twenty-two ratio steps from 5/5 A to 2,000/5 A, inclusively, and fifteen ratio steps from 1/1 A to 200/1 A, inclusively. They also have maximum ratio and phase-angle errors between 120 and 10 per cent. of full load on all ranges not exceeding 0.02 per cent. of the value measured and 0.9 minutes, respectively. Further, they can be energised from a three-phase or single-phase source, either from the battery-driven motor-alternator set, the mains supply or from the 1,000-A polyphase meter test bench situated in a room directly underneath the laboratory proper. Used in conjunction with the two reflecting wattmeters these transformers cater for measuring both single- and three-phase power with currents ranging up to 2,000 A to an accuracy of ± 0.05 per cent. of the values being measured.

They are also used as a departmental check for the determination of the errors of test room class AL current transformers and service metering transformers, the comparison measurements being effected by means of an N.P.L. type direct-reading precision current transformer testing equipment which has nominal ranges of ± 0.5 per cent. ratio error and ± 2.5 minutes phase-angle error, with scale multipliers of 10 and 100. The accuracy of measurement that can be obtained is of the order of 0.01 per cent. and 0.1 minute for ratio and phase-angle error measurement, respectively, when used on the direct range. The precision multi-range current transformers used as standards are provided with 1/1 ratio windings, so that they can be self-checked against the equipment. Although the original DC/AC potentiometer is not used now for standardising purposes it has a useful sphere in the new scheme in permitting the accurate measurement of DC and AC values and power factors and for cross-checking other equipment.

Not the least important part of the laboratory equipment is the very comprehensive range of portable testing equipment, including the substandard instruments. A Synchronome seconds pendulum clock, with a separate seconds dial, which is used as a time standard, is cross-checked against the radio time signal each day. A separate room accommodates the lead-acid batteries for various DC laboratory supplies, and there are also five AC motor-driven DC generators which afford supplies at different voltages.

By rotating the stator of the 3-kVA alternator of the tandem battery - driven motor - alternator set the P.F. can be varied from zero lag to zero lead

In addition to various mains supplies for AC there is the tandem-battery-driven motor-alternator set which has two separate alternators to give respective outputs of 10 kVA and 3 kVA, three-phase. The stator of the 3-kVA alternator can be rotated through 200 electrical degrees, and since this alternator is normally used for voltage only and the 10-kVA alternator for current only, the power factor of the joint phantom supply can be varied between the limits of zero lag and zero lead. The alternator set is controlled from the laboratory from a portable control desk.

The voltage of the 3-kVA alternator and of the mains can be controlled precisely within the range of 0 to 500 V. Current supplies from the 10-kVA alternator and the mains are stepped up by means of three 20-kVA low-voltage transformers to maximum values of 2,000 A, coarse current control being effected by means of on-load tap-changing auto-transformers operated from the laboratory proper, while fine regulation is afforded by remote control of the motor-operated alternator field rheostat.

We are indebted to Mr. John R. Struthers, M.I.E.E., general manager and engineer of the Sheffield undertaking for permission to view the laboratory and to take photographs, and to Mr. R. H. Coates, technical assistant, and Mr. F. E. Meredith, meter superintendent, and his assistant, Mr. F. Seddon, for their help in compiling these notes.

Alexander Bain Centenary

UNDER the auspices of the Edinburgh Electrical Society and the Royal Scottish Society of Arts there was unveiled at Edinburgh on Saturday last, a tablet commemorating the centenary of Alexander Bain's invention of the electric clock system. The tablet, erected at 21, Hanover Street, bears the inscription—"Workshop of Alexander Bain, electric clock and telephone inventor, born 1810—died 1877."

The unveiling took place in the presence of a large gathering, the ceremony being performed by Col. H. Carter, M.I.E.E., deputy regional director, General Post Office.

In his eulogy of Bain, he said that they had commemorated in the city the birth of two sides of electrical communication, the telephone and the telegraph, for several years ago a similar tablet was unveiled to the memory of Alexander Graham Bell.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

A GREAT many electrical people will be pleased to hear of the appointment of **Mr. W. J. Jones,** M.Sc., M.I.E.E., as director of the Electric Lamp Manufacturers' Association, as from January 1st, in succession to Mr. C. W. Sully, who has retired. Mr. Jones was for four years assistant engineer and manager of the Lighting Service Bureau with Mr. W. E. Bush and in succeeding Mr. Bush in 1928 he had a very live wire to follow. That he was a worthy successor has been abundantly proved during the past twelve years or more. He is one of the most ubiquitous of men. Although he always seemed to be giving lectures in widely-different parts of the country in a remarkably short space of time it was possible to find him at the Bureau whenever information was wanted.

Mr. W. J. Jones

In addition to his lecture and demonstration work he has been active in establishing provincial Lighting Service Bureaux which have brought this valuable work within the reach of many more thousands of electrical engineers and contractors as well as architects and laymen. The most useful recent work has been in connection with factory lighting which has indeed been an important national service.

Mr. Jones is an old Finsbury student and an A.C.G.I. Before joining E.L.M.A. he was with A. C. Cossor, Ltd., where he was in charge of about a thousand operatives in the production of valves and instruments.

Mr. H. M. Pease, who, from 1902 to 1928, was intimately connected with the progress of the Western Electric Co. and later of Standard Telephones and Cables Ltd., was on January 7th elected to the presidency of the International Standard Electric Corporation of New York, in succession to Colonel Sosthenes Behn. Mr. Pease, who has played a prominent part in the development of modern communications in Great Britain and overseas, was elected to the board of the Western Electric Co., Ltd., in 1913 and was managing director of this company and of Standard Telephones and Cables Ltd. from 1919 until 1928. In 1927 he was given the additional appointment of vice-president and European general manager of the International Standard Electric Corporation. The pressure of work occasioned by the new appointment made it necessary for Mr. Pease to relinquish the managing directorate of Standard Telephones and Cables Ltd. In 1933 Mr. Pease was appointed executive vice-president and he has now, after forty-two years' service, attained the position of president.

It was recently reported that **Mr. W. Dundas** had been appointed city electrical engineer of Bradford. We now learn from the *Yorkshire Post* that the appointment of a successor to the late Mr. T. Roles has not yet been settled. The Finance and General Purposes Committee on January 7th referred back to the Electricity Committee a recommendation that Mr. Dundas should be given the post and that a deputy electrical engineer and a commercial manager should also be appointed. This decision was reached by a narrow margin—14 votes to 13—and was really designed to separate the actual posts from the salaries attaching to them, the object being to fix the salaries first and then to recommend appointments for the approval of the City Council. The principal appointment carries a recommended salary of £1,500 rising to £1,750, the deputy electrical engineer's salary is from £850 to £1,000 and the remuneration of the commercial manager is from £800 to £950 per annum.

Mr. J. Wilkinson has been appointed chief electrical engineer to the Newall Engineering Co., of Peterborough. Prior to receiving this appointment Mr. Wilkinson was assistant in charge of the testing and connecting department of the West Kent Electric Co., Orpington, and was previously installation inspector with the Southend-on-Sea Corporation Electricity Department and assistant to the installations engineer with Peterborough Corporation Electricity Department.

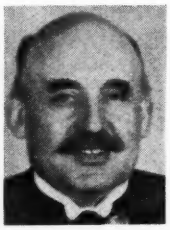
Newcastle-on-Tyne City Council has confirmed the appointment of **Mr. H. C. Godsmark,** general manager of Huddersfield transport undertaking, as general manager of the city's transport and electricity undertaking. Mr. Godsmark was unable to attend the City Council meeting owing to a motor accident in which he received injuries necessitating his detention at Huddersfield Royal Infirmary.

Hull Corporation Electricity Committee has appointed **Mr. E. P. Mitchell** of Darlington as shift charge engineer.

Mr. G. H. Pulfrey, general manager of the St. Helens Corporation Transport Department, has been appointed general manager and engineer of the Hull Corporation transport undertaking.

Mr. R. Alan Thwaites, engineer and manager of the North Wales Power Co., has been appointed a member of the National Consultative Committee of the Central Electricity Board.

Mr. R. W. Grubb, M.A., M.I.E.E., borough electrical engineer and manager of the Dewsbury Corporation electricity supply undertaking is retiring under superannuation in March. He served his apprenticeship with the Electric Construction Co., Ltd., Wolverhampton, and the Oxford Electric Light Co. After appointments at San Remo and Eastbourne, he became chief assistant engineer with the Swindon Corporation, and in 1910 obtained the post of chief assistant electrical engineer to the Dewsbury Corporation Electricity Department, being appointed borough electrical engineer and manager in 1919.



Mr. W. A. Harriman, general director and works manager of A. Reyrolle & Co., Ltd., who received the M.B.E. in the New Year's Honours

The address of **Mr. Horace Boot** (Horace Boot & Partners, Ltd.) consulting engineer, is now Clarefield Court, Pinkney's Green, Maidenhead, Berks.

Dumfries County Council Electricity Committee have raised the salary of **Mr. J. S. Pickles,** county electrical engineer, from £1,000 to £1,200 per annum.

Mr. T. Forrest, chief clerk in the Southport Corporation Electricity Department, is retiring after forty-seven years' service with the Corporation.

Mr. E. W. Dorey, A.M.I.E.E., electrical engineer, has removed to 67, Crescent West, Hadley Wood, Barnet, Herts.

Obituary

Mr. C. Oliver.—We regret to record the death, early in December, of Mr. Charles Oliver, M.I.E.E., founder of Oliver Pell Control, Ltd., Woolwich, and one of the pioneers of the electrical industry. Forty-three years ago he started a small factory under the name of Oliver & Co. to manufacture arc lamps. Later he was joined by the late W. M. D. Pell, son of Mr. Pell of Brockie-Pell fame, and Mr. Oliver then designed and produced in 1911 the longest burning magazine flame arc lamp then known; examples installed in the City of London in 1912 are still in service.

Among the designs and developments which he fostered, his system of distant control of switchgear by mains ripples, the purchase and development of the Varley Magnet Coil Winding Co., now one of the largest in the country specialising in this work, and the manufacture of Varley wireless sets and components, stand out as pre-eminent. In recent years, the development of the Varley dry accumulator occupied much of his time.

Dr. D. Robertson.—We regret to report the death, on January 8th, of Mr. David Robertson, D.Sc., M.I.E.E., Professor of Electrical Engineering at Bristol University. Dr. Robertson, who was sixty-five years of age, was educated at Helensburgh and the Glasgow Technical College, of which he was an Associate and Pender gold medallist. He took the B.Sc. degree in engineering at Glasgow University in 1899, with distinction in electrical science, and he was a Walker prizeman. He received practical training with James White, Ltd. (predecessors of Kelvin, Bottomley & Baird, Ltd.) and commenced his scholastic careeer in 1900 as engineering lecturer at Bradford Technical College. In 1902 he was appointed to the chair of electrical engineering at Bristol and had thus been at the University for about thirty-eight years.

Mr. W. S. Edwards.—We regret to learn of the death of Mr. Wodehouse Samuel Edwards, M.I.Mech.E., A.M.I.E.E., which occurred at Bexley, Kent, on December 26th. Mr. Edwards served his time with Sissons, at Gloucester, and afterwards worked with Spencers', Melksham, Wilts, from where he went to Willans & Robinson, Ltd., Rugby. During the last war he was lent by Willans & Robinson to the Admiralty and he returned to them at the cessation of hostilities. In 1919 he joined Fraser & Chalmers Engineering Works of the General Electric Co., at Erith, and occupied a prominent position in the Material Handling Department, and was responsible for many large schemes in this country and abroad. Mr. Edwards, who was sixty-two years of age, leaves a widow and three daughters.

Mr. Lachlan P. MacKenzie, chairman of MacKenzie & Moncur, Ltd., the Edinburgh engineers, died on January 10th, at the age of seventy.

We omitted to mention last week in our obituary notice of **Mr. W. Cruickshank** that he was editor of the *Post Office Electrical Engineers' Journal* for eighteen years.

Meter Certification

Past, Present and Future

By S. H. Richards, M.I.E.E., M.Am.I.E.E.

THERE is a fundamental difference between the specialist and casualist in testing practice in the consideration of the application of the Electricity Supply (Meters) Act, 1936. The Act has become an incentive to the specialist, as an opportunity to improve standard and substandard apparatus and to attain to higher degrees of accuracy consistent with economic values. The casualist, however, while compelled to observe certain standard conditions, has been content to retain accuracy limits just within those prescribed in the Electricity Commissioners' documents. It must be recorded that specialists have been found in lonely places, men who strove with might and main in adverse circumstances to worthily uphold their calling, the results of whose work were remarkable. Such men have welcomed the conditions laid down by the Electricity Commissioners as they have given them pride of place in the opportunity afforded and the advantages gained.

The 1936 Meters Act put meter testing on a more solid footing and although wartime considerations have necessitated relaxation the author hopes that the ground gained will not be lost

The history of the Act, even during its short period of operation, is interesting in the periods before and during the war. Observation leads to the conviction that new values are being placed upon its importance. Inevitably, however, the mind travels into the unknown future. What will be the position after the war ?

Initially, the practical application of the Act was in reality the re-breaking of old ground, for the very important factors of approvals of type and certification of meters, legally enacted as far back as 1899, had become more of a memory than an operational fact. In spite of this, in fairness to the industry it must be stated that in a large number of undertakings reasonable care was taken to ensure that "accurate" watt-hour meters were connected to electricity consumers' terminals. The justification of this statement is now history, for it can be shown that undertakers not only realised their responsibility, but also responded to it.

The Past

Prior to September, 1939, a solid foundation was being laid for the future of testing departments and the staff of electricity undertakings. The original documents of the Electricity Commissioners, while meeting with a certain amount of adverse criticism, were generally welcomed as sound in principle, and at the same time not placing too great a financial burden upon the industry in general. Many predominant objections gradually disappeared as the inner meaning of the legal documents came to be more fully understood, and an appreciation of their worth more fully defined.

Mr. Richards is chief meter examiner to the Electricity Commission

In spite of the care taken in construction and detail of the complementary documents to the Electricity Supply (Meters) Act, 1936, operational difficulties were noted when they were applied. The instructions had to be modified in order that certain aspects in relation to testing apparatus and testing methods should be more clearly defined. The Electricity Commissioners therefore decided to reconstitute the Technical Committee, and the work of this Committee, while not complete when hostilities suspended its deliberations, has already had a fundamental and valuable bearing upon the practical application of testing methods. Completed documents have not been published because of the war, but they have been made known through the Commissioners' examining staff. The information given has been acknowledged as valuable.

Fears have been expressed that the issue of regulations covering every detail of meter testing and handling would kill all life and initiative and reduce all testing stations to a dead level of mediocrity. These fears have not been realised, for the recommendations emanating from the Technical Committee and agreed to by the Electricity Commissioners have been generally welcomed as of practical value. Acknowledgment must be made both to the industry and to testing engineers who so freely gave of their time, thought and experience in order that a stabilised and ordered system might be brought to being. The work already accomplished justifies the hope that this work will be completed.

Consideration of the early days indicates that material progress had been made by September, 1939, for while at no time had rejections of meters given cause for alarm, by the time the war began they had become a negligible percentage of the total submitted. It had generally been assumed that certification of meters would only concern those used for the ordinary consumer, and that special agreements for large consumers would stand as heretofore. The trend of events, however, indicated that supply authorities were considering the application of certification to such cases. New problems arose, both with respect to new and old power consumers, and conditions were under consideration by many authorities as to the advisability of certification with "special" agreements, or of certification as a primary factor for all metered supplies.

During the immediate pre-war period, problems arising with respect to the safe and satisfactory housing and use of standards and substandards had been solved in the majority of cases, and the normal routine check of this apparatus, together with testing for certification, proceeded normally. Examiners on the Commissioners' staff had taken up systematic routine calls and the smooth running of a well-organised machinery was in being. Normal contacts between testing staffs and examiners gradually wore down mutual suspicion, and not only created a more friendly atmosphere, but an interchange of views between those concerned with certification was productive of suggestions and ideas which, where practical and economic, were immediately adopted. In fact mediocrity was taboo, and there arose a spirit of friendly rivalry which was conducive to greater efficiency.

The net result of this initial phase might be summarised by stating that the importance of accuracy in the commercial measurement of electrical energy became more predominant; and the attention given to metering accuracy meant that "bench" accuracy for certification had improved by more than 50 per cent. in a little over two years. That is, originally testing stations were content to submit meters within the tolerance band of + 2.5 and —3.5 per cent. for certification; now the greater proportion of undertakings' testing stations aim at and attain to a band of ±1.5 per cent. Similar remarks apply also to the care and use of standard and substandard apparatus.

A new appreciation of values predominated testing departments, and it was possible to visualise an increased desire to attain to still greater efficiency without increasing the cost. Men in charge of these departments took a new pride in their work and new methods were introduced, because incentive was aroused. One such department prides itself that, although accuracy has increased, the charge for certification has been counterbalanced by reorganisation which put essentials first, thereby increasing the output per tester.

Then came the war, and the organisation which had been built up had to be remodelled to face new conditions. The crisis of September, 1939, brought to notice the following possibilities: The reduction in personnel of testing stations; the reduction of new service connections; and undertakings restricting the change-over of meters during the ten-year period.

Arrangements were made whereby one, or a combination, of the following proposals could be immediately put in hand in

order that certification of meters should continue:—(1) The centralisation of testing in testing stations geographically convenient; (2) The use of manufacturers' test rooms on a temporary basis for meter certification; (3) A considerable reduction in the visits of examiners to testing stations.

The Present

The position forecast in the ELECTRICAL REVIEW of January 26th, 1940, has proved fairly accurate. It was not long before the Electricity Commissioners' examining staff was reduced from thirty to seven. Suggestions (2) and (3), immediately put into effect, have worked satisfactorily, and the anticipated general decrease in the requirements of undertakings declined as the war progressed.

This decline in meters submitted for certification has naturally not been consistent throughout the country, but has varied with the ebb and flow of the population due to evacuation, etc. As a whole, the call for certified meters gradually decreased until quantities stabilised at about one-third of normal needs. Postal certification instituted as a safeguard against abnormal requirements has been used only in cases of extreme urgency; in general, undertakings have looked ahead and have been able to carry on until an examiner's visit.

Visualising the difficulties which must necessarily be encountered during days of stress, when lack of personnel and other duties both combined to make conditions applicable to normal time onerous, the Electricity Commissioners intimated to the industry that while, wherever practicable, normal testing of standards and substandards should continue, modifications would be allowed in all cases of necessity. On July 1st, 1940, and after consultation with the Joint (Emergency) Committee of Electricity Supply Associations, the Electricity Commissioners therefore issued a series of recommendations which contained the following variations of pre-war requirements and general recommendations:—

1. CERTIFICATION OF METERS.

(*a*) Individual tests may be omitted from certification forms provided that (i) all meters entered on the form are within the limits of error of +2 per cent. and —3 per cent. and do not "creep" with a voltage 10 per cent. in excess of their marked voltage; (ii) a statement to that effect is signed by a responsible official.

(*b*) Postal certification will be accepted if the area meter examiner accepts the tests.

(*c*) The area meter examiner will visit stations, so far as possible, and has discretion in deferring signing certification forms until a visit has been made.

(*d*) Summary forms must be enclosed in duplicate.

(*e*) Recertification of prepayment meters on pink forms is suspended.

2. TESTING OF APPARATUS AND METERS.

(*a*) *General.*—Wherever possible the normal periodic testing of apparatus and the approved testing of meters should continue.

(*b*) *Standard Apparatus.*—Potentiometer equipment may still be sent to the National Physical Laboratory, but the requirement is suspended till further notice.

(*c*) *Substandard Indicating Apparatus.*—Tests to be made either (i) at the working points down to 40 per cent. of full scale on one range, and at one working point on each of the other ranges, at intervals of not less than six months; (ii) at one working point on each range at intervals of not more than three months.

(*d*) *Rotating Substandards.*—Test periods for (1) polyphase meters, as heretofore; (ii) single-phase meters when used single every two months, and when used in pairs every six months.

(*e*) *Meters.*—Certain types may be tested at 10 per cent. of marked current instead of 5 per cent. A reduction of duration of time for dial tests may be allowed at the discretion of the area meter examiner.

3. INSTRUMENT REPAIRS.

(*a*) *Potentiometer Equipment.*—In general, local repairs are undesirable. If any repairs are proposed to be carried out locally, the area meter examiner must first be consulted.

(*b*) *Substandard Indicating Instruments.*—Repairs, other than those disturbing the movement, may be carried out locally. Where it is necessary to carry out repairs involving disturbance of the movement, the area examiner must first be consulted.

(*c*) *Standard Clocks and Stop Watches.*—Repairs may be made locally.

(*d*) *Rotating Substandards.*—Repairs may be made locally, subject to prior consultation with the area examiner.

Considering the fact that the testing engineer was called upon to take in work of national importance, together with the consequent depletion of staff in testing stations, it could naturally be assumed that such amelioration of conditions would be welcomed and readily adopted. In the great majority of cases, however, testing stations continue to observe in all respects the original conditions laid down by the Electricity Commissioners. Substandard apparatus is being tested within the normal allotted period, and meters are put through the tests as originally laid down. As one testing engineer remarked, "Why spoil a good job by easing down essential requirements?"

Many hundreds of thousands of very old meters are available to the industry and in normal circumstances such meters would be "scrapped." Under war conditions it was desirable that they should be used if possible. The Electricity Commissioners, therefore, agreed that such meters might be tested at 10 per cent. instead of 5 per cent. of full load. Rarely has this relaxation been sought and in the great majority of testing stations meters are tested and submitted for certification to the original requirements. This is all the more remarkable in view of opinions expressed not more than three years previously, and is indicative of the spirit that has grown in a short period. It serves to emphasise the keenness of the individual and the improvement of technique and augurs well for the future.

The Future (Post-War Period)

Now the testing engineer has a duty to his employers, to the public, and to himself, and this three-fold aspect of responsibility is not complete unless it is viewed both from the individualistic and communal points of view.

In the early days of testing the predominant view was individualistic, and the testing engineer was concerned with the problems immediately affecting himself and his undertaker's supply. In spite of the general arid aspect of testing stations there emerged oases that were a welcome sight in a barren land. Men who by their initiative and vision created testing departments worthy of the name, and in that section of the industry carved out a heritage for themselves. All credit to those who were able through ability and personality to accomplish so much, and more power to chief engineers and managers who appreciated the importance of a first-class testing department.

Such instances were, however, uncommon, and a collective move was not possible until the Act of 1936 became operative. Individualism had created testing stations that were good, but left the general position poor; now came the opportunity for a general survey, the uplift of testing stations and practice throughout the United Kingdom to a reasonable standard. The Commissioners' requirements opened up a new vista to testing engineers and indicated the road which should be taken if economic efficiency in general practice was to be attained. Nominal requirements as well as maximum testing periods were laid down and in the majority of undertakings accepted as such.

Many testing engineers in the industry, however, felt that the compulsory apparatus and testing methods laid down might with advantage be amplified, not with further mandatory requirements, but with permissive suggestions, which could be used at the discretion of undertakings. So the work instead of remaining static became dynamic, alive, filled with new inspiration and new ideas towards a more comprehensive and commercial ideal than had yet been visualised.

The war stopped all this, but the question that is being repeatedly asked is, will the industry move forward in attaining to better and newer ideas, or will the present system, because it is suited to exceptional conditions, continue? In conversation with members of the industry it is evident that real alarm is latent, sometimes expressed, lest possibilities which have arisen should be lost, and that opportunities gained should be superseded by methods allowed under war conditions.

The Electricity Commissioners laid the foundations for economic efficiency. The broad principles they enunciated proclaimed a fundamental, though general, idea by means of which the Meters Act could be operated. The clarity of thought and conception of farseeing testing engineers (through the Technical Committee) began a structure which, taking shape, envisaged practice for the future which was fraught with meaning. Must this work come to naught? Should it not rather be a stepping-stone for something better? Should testing engineers limit their thoughts entirely to immediate problems concerning

their own undertakings and not consider and reconsider post-war problems ? Shall we remain content with things as they are, and not preach the gospel of efficient testing, pointing out the fundamental position of testing stations in relation to finance, engineering and the consumer ? .

If we are to plan for the future, planning must begin now, and if it is to be successful its discipline must be willingly accepted by all for the common good. Testing has always needed, and to-day more than ever needs, men of vision and personality ; men who can see beyond the confines of their own testing stations to the needs of testing stations throughout the country ; men who are willing for the sake of others to be circumscribed that others may become free.

The work that has already been prepared by the Technical Committee can by no means be called complete. It was a beginning which already, in the light of later knowledge, will have to be reconsidered. It is work that can by no means be classed as the work of the Technical Committee alone. It has drafted, but that drafting has been due to the development of ideas propounded by many who may not be recognised because of the part they played in the background. Such, however, consider their part well played in imparting the knowledge they possessed. So must it be with all broadminded men ; what matters, so long as knowledge has been imparted, and progress made.

The work begun by the Technical Committee must be finished in the light of present knowledge, and amplified as knowledge increases. Ways and means for helping the newcomer in testing stations must be defined ; the path must be made plain, obstacles must be removed. Let us get together, then, tabling our knowledge and our methods. Let us indicate what is the best practice, forgetting self and our own idiosyncracies, and putting forward the ideal to be attained.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions.

Glass Bulb Rectifiers

IN the course of the last year or so there has been considerable discussion amongst engineers regarding the robustness of glass bulb mercury-arc rectifiers, and their ability to stand up to conditions of aerial warfare. Although we have always had complete faith in the ability of the glass-bulb rectifier to hold its own against any other form of converting plant in this respect, it is only recently that actual practice has proved this point, and we think that your readers will be interested in a further example of the robustness of glass-bulb rectifiers which has just come to our notice.

Owing to enemy action it recently became necessary to transfer one of our large four-bulb rectifiers from one part of the country to another approximately 100 miles distant. The matter was one of extreme urgency, and in the rush to get the rectifier moved, the bulbs were inadvertently left in the cubicles and were transported in this manner from the one situation to the other. This included barring the cubicles up planks on to a lorry, and the lorry then made an average speed of 20 miles an hour over some rather inferior quality roads to its new destination. On arrival on site it was found that three of the bulbs functioned perfectly, while the fourth bulb, although mechanically intact, had lost its vacuum and only required re-pumping.

When it is stated that the weight of mercury in each of the bulbs was 40 to 50 lb. we feel sure that any engineer will realise the tremendous buffeting the bulbs must have received in transit. We certainly do not wish to suggest for a moment that a habit should be made of transporting bulbs in their cubicles, but we maintain that in actual practice the glass bulb mercury-arc rectifier has repeatedly proved itself to be the most reliable, convenient and economical type of converting plant at present on the market.

Wolverhampton,
December 31st.

ELECTRIC CONSTRUCTION CO., LTD.
Wm. M. Furniss, *Director and Manager.*

PROJECTOR LAMPS

FILAMENT projector lamps are to-day being increasingly used in place of carbon arcs on account of the smallness as well as brightness of the light source and the compactness of the bulbs. These depend on a closely bunched tungsten filament, which retains its shape at very high temperatures, and on a highly refractory glass.

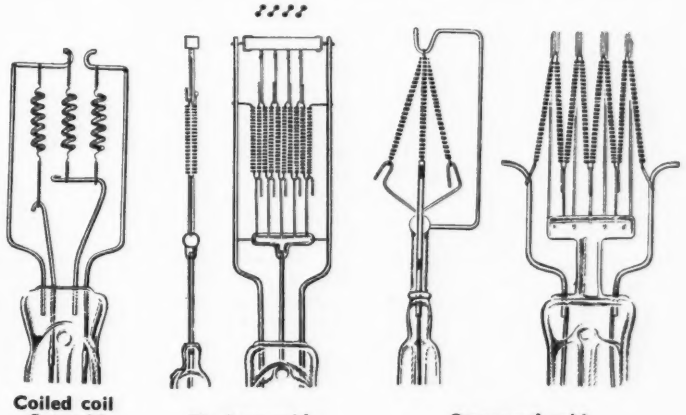
The three usual shapes are the rectangular, the spherical and the cylindrical. The rectangular type consists of a number of short straight coils placed side by side to produce a " flat-grid " filament, and one of $\frac{1}{2}$ in. square can be produced from a piece of wire 2 ft. long and 0.004 in. in diameter.

For a magic lantern the ideal would be a light source of uniform intensity and the same size as the slide in front of it, but as a piece of thin tungsten wire could not cover a 3-in. square standard lantern slide, a small coiled-coil grid filament of the same shape but smaller is mounted at a convenient distance from it. The light is collected by a large condenser lens and distributed evenly over the area of the slide.

The optical system of a cinema projector is similar, but the " slide " is only one frame of the moving film, which may vary from $\frac{7}{8}$ by $\frac{3}{4}$ in. for 35 mm. film to $\frac{1}{4}$-in. square for 8 mm. film. In practice the image of the filament formed by the condenser is produced close to the gate containing the film, instead of in the aperture of the objective as in the magic lantern. Being nearly in the focal plane, this image, and therefore the filament itself, must be as even as possible in order to avoid irregularities of illumination on the screen. For this reason the filaments are arranged as a rectangular grid with the coils close together and parallel. In old type equipment gaps between the straight coils were filled up with a reflected image of the adjacent coils from a reflector behind the lamp. Nowadays the same effect is accomplished by mounting closely together two filaments in the bulb with the coils of the rear filament opposite the gaps in the one in front ; this forms a bi-plane filament. Where vibration is considerable, short circuiting of adjacent coils is avoided by providing increased clearance by means of a " staggered grid."

Floodlighting usually needs the projection of a fairly wide angle beam from the reflector, and lamps have to operate from the mains voltage. Floodlight reflectors are usually deep, and a flat-grid lamp, which sends no light in the plane of the grid, would be unsuitable. The most effective shape of filament is cylindrical with a diameter rather less than its length made up of a series of straight coils formed like a cage.

Sometimes the floodlight beam, instead of being circular in section, is required to be flattened out, as when lighting an aerodrome, where a beam of only a few feet high floods a wide and deep area of the landing field. The reflecting mirror for this purpose is generally a trough having a parabolic section, in parallel with the length of which runs a thin and straight light source, such as coiled " line " filament some 8 in. long and 0.04 in. in diameter.



Coiled coil flat grid — Bi-plane grid — Staggered grid

Further information on projector lamp design is given in a publication (No. OS.9021) of the General Electric Co. Ltd., which also includes many tables likely to be of assistance to users of this type of lamp.

Indicating Instruments

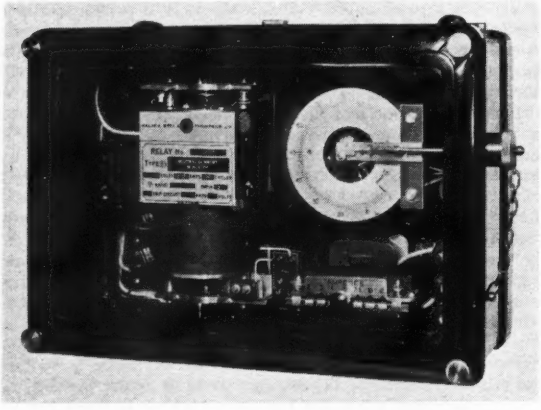
Location and Analysis of Line Faults

By C. W. Marshall, B.Sc., M.I.E.E.

Oscillograph records do not meet the wartime need for the rapid location of faults. In this article alternative means are briefly reviewed by the author who is able from his grid experience to assess their value

THE instrument equipment used in electrical power circuits has long been stereotyped, if not standardised. The customary equipment served its purpose well for the comparatively easy conditions which pertained during peacetime. The very different class of duty which the war has imposed on all classes of electrical apparatus has made it necessary to re-orient our thoughts. First, there is the matter of size of instrument. The advocates of miniature types who have, up till comparatively recently, only made slight headway towards their objective of displacing the larger instruments have now a real opportunity to set a new fashion.

It is quite clear from airplane and motor car practice that such instruments serve admirably for the control of powerful prime movers. The comparatively simple duty of controlling turbo-alternator, transformer, and feeder circuits is therefore easily



Neutral current indicating integrator

within the compass of similar instruments that can be assembled in very small switchboard units which need not be larger than the customary motor-car dashboard. The advantages of such an arrangement, particularly for emergency control rooms, require no stressing.

Fault Finding on Overhead Lines

Another matter which is being brought very forcibly to our notice is that the long period of immunity from high fault rate on electrical equipment, overhead lines and cables has provided no incentive to instrument makers to develop instruments for fault analysis. The conventional methods of resolution by means of oscillographs recording photographically is ill-suited to war conditions. It is, therefore, important to know that alternative means are available for obtaining quickly, most of the information regarding fault conditions which can be deduced slowly from oscillograms.

For example, the "Atkins" method of fault location on systems with multiple earthing of the neutral point requires only indicating instruments for its application. This scheme ascertains the position of earth faults by measuring the neutral currents during the fault, at the two ends of the faulty section. The fault current is measured either by means of an integrator, which determines the average current over a period of the order of 0.2 second, or, alternatively, by a maximum demand ammeter. The value of the system lies mainly in the reduction of the time which is normally taken to find the physical position of faults on overhead lines.

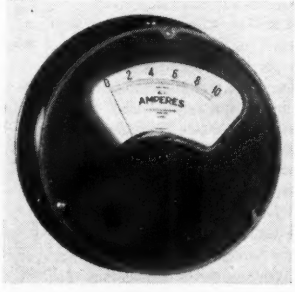
The neutral current indicator which has recently been designed and manufactured by Nalder Bros. & Thompson, Ltd., to the requirements of Mr. W. T. J. Atkins comprises three essential parts, namely, a detector, a switching device and an integrator. The switching device is designed for determining the period of energisation of an electrical measuring instrument which is adapted to indicate the magnitude of a transient, or other abnormal condition, in an electric circuit. The switching (timing) device is released by detector means sensitive to the presence of the transient, or abnormal condition. The time setting is constant and independent of the magnitude of the fault current.

The indications of the integrator thus depend on the magnitude of the abnormal condition during the time interval fixed by the switching device. The indications of the integrator can be read directly in percentage values on a circular scale approximately 8 in. long as illustrated.

Mr. C. W. Marshall, B.Sc., M.I.E.E., is chairman of the I.E.E. Meter and Instrument Section and a technical officer of the C.E.B.

The alternative maximum-demand ammeter was developed by Mr. F. E. J. Ockenden and made by Everett, Edgcumbe & Co., Ltd., in response to a request of the Central Electricity Board. It is of the moving-coil pattern and is rectifier-operated, being fitted with a maximum demand pointer only. This meter is capable of responding to transient fault currents of as brief duration as one-tenth of a second. It is scaled for a maximum of 10A and is connected to the neutral line through appropriate current transformers. A push-button on the side of the instrument case increases the sensitivity of the readings ten times, and in this way enables the presence of small fault currents in a circuit to be easily and quickly ascertained.

This ammeter type of instrument has the additional merit of being easily adaptable for measuring load and short-circuit currents, the latter quantity being valuable as indicating the stresses involved in disconnecting the faults.



Moving-coil maximum demand ammeter

For more complete analysis of fault conditions the so-called oscillo-perturbograph has proved to be exceptionally useful in that it is possible to get records of three currents and three voltages, and one other quantity, with the minimum of personnel for attending to the instruments. The weakness of this instrument in its original form, which is not likely to be now available in this country, is that the degree of accuracy of measurement of voltage and current is not high.

It is hoped that the necessary development work will be undertaken in order to eliminate this lack of accuracy and so to provide a still more powerful means of fault analysis for the use of protective gear maintenance staff.

Transmission System Faults

Use of Measurements of Fault Conditions

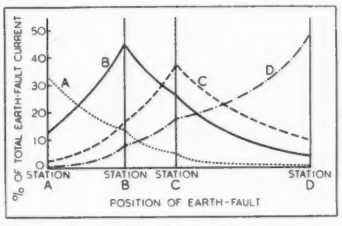
By W. T. J. Atkins, B.Sc.(Eng.), A.M.I.E.E.

THE employment of relays which behave fundamentally as ohmmeters has been standard practice in "distance" protective schemes for several years. Certain types of these relays are arranged to give more or less approximate indications of the magnitudes of the effects which have caused them to operate, and hence of the positions of faults. Even when such indications are readily available, however, it is not generally practicable to utilise them for anything more than rough estimates of the locations of faults.

Nevertheless the advantages, particularly in the saving of time, of obtaining fault locations from data produced by the faults themselves are manifest, yet so far as the author knows the only methods which have so far been applied to this end have involved the use of oscillographs automatically set into operation on the occurrence of a system disturbance. These methods suffer from the obvious drawback that the photographic records need collection and processing, and so are not immediately available for computation, etc. What then, are the various conditions that are to be satisfied in a scheme which is intended for workaday use in fault location?

The author, who is a technical engineer, Mid-East England Area, Central Electricity Board, explains the nature of fault indicators needed for everyday use and the rapid employment of results to locate positions

Whatever principle underlies the method of location, three essential requirements must be fulfilled in the type of instrument employed. (1) The reading must be indicated by a pointer, or the like, and the instrument must be suitable for switchboard mounting, so that it may be installed where it can be kept under continuous observation. (2) The reading must be set up within a period of the order of 0.15 sec. from the initiation of the fault, and thereafter must not be disturbed by any subsequent events until the instrument has been re-set to zero. (3) The accuracy must not be greatly inferior to that expected from a conventional indicating instrument.



Typical distribution of transformer neutral currents

The need for the first and third of these conditions will readily be understood. The second arises because it is essential (*a*) to complete all measurements before the general conditions on the supply system are altered by the tripping of switchgear, 0.15 sec. representing about the limit of time that can be allowed with modern circuit-breakers and protective equipment, and (*b*) to retain the reading, irrespective of further disturbances, etc., until it is observed and noted.

Phase-sequence Measurements

The suitability of any particular quantity for use as an indication of fault positions is largely governed by the design of the transmission system. The main need is for a rapid rate of variation with fault position, and there is little doubt that impedance (or reactance) would serve the purpose very well, but a somewhat formidable battery of instruments would be necessary, and the influence of the fault itself might not always be negligible. The alternative of a combination of current and voltage would be still more complicated while offering no compensating advantages. Fortunately, a simplification is possible in polyphase circuits by the use of phase-sequence quantities, and these can be measured directly by well-known methods. Even so, preliminary study is necessary to ensure that the chosen quantity is inherently capable of yielding useful results.

The 132-kV grid system is well adapted to the application of the foregoing ideas, owing to the circumstance that the neutral points of all transformer higher-voltage windings are solidly earthed. Although conditions are not so favourable on the lower-voltage systems where multiple earthing is not in use, the arrangement of the lines in ring mains affords other possibilities, but these have not yet been exploited. What follows is a description of a method which has been applied with success throughout the Mid-East England Area of the Central Board's primary system, and is being applied to a limited extent in other areas.

The great majority of faults on the grid system, as on all other outdoor systems, are faults to earth, usually affecting one phase only, but occasionally two phases simultaneously. The resulting earth fault current divides between the various return paths provided at the 132-kV transformer neutral points in a manner solely determined by the impedances to zero phase-sequence currents of the transformers and lines. For a given fault position the relations between the transformer neutral currents are unique, and by reason of this can be used to ascertain the location. It is to be remarked that these current relations are entirely independent of any impedance which may be present at the fault, or of the amount and disposition of generating plant supplying the fault. The graph illustrates in typical fashion how the neutral currents vary as the fault changes position within the zone covered by the diagram.

Special Current Indicator

In the practical application of this scheme, a current indicator having the special characteristics described on the preceding page is installed in the control room of each power station associated with a 132-kV grid transforming point. This indicator is energised from the secondaries of current transformers in the main transformer neutral earthing connections. Immediately after the occurrence of an earth fault the indicator readings are telephoned to the Central Electricity Board area control room, where they are tabulated for purposes of location. Once collected, the readings are converted to neutral currents and the ratios between pairs of the latter enable the position of the fault to be read from curves, resembling those reproduced above, on which the abscissæ are marked in actual tower numbers.

The curves are plotted from data obtained from an AC calculating board representing the zero-phase-sequence network of the transmission system. In this way the location can be made available within some 15 minutes of the occurrence of the fault, provided that the system conditions were "normal" at the time.

If, on the other hand, an "abnormal" condition should exist; for example, a line or transformer being out of service for maintenance, the curves would not give an accurate result and it would be necessary to set up the special conditions on the calculating board. This does not, however, more than double the time required to obtain the location.

Practical experience with this system now extends over a period of about three years, during which a considerable number of faults have required location. Apart from a few cases in which instruments were out of adjustment, or when there were unexpected circumstances at the site of the fault, the accuracy realised has been within 5 per cent. of the route length of line involved. Those responsible for the continuity of service of overhead lines of considerable length will appreciate the value of such results.

Australian Radio Ban

IN accordance with national safety regulations, four commercial radio broadcasting stations have been closed down, one each in New South Wales and Queensland, and the other two in South Australia. The stations, which are operated by a religious sect, are said to have transmitted information likely to be of use to the enemy.

Instrument Design

Progress as Reflected in Standardisation

By John F. Stanley, B.Sc., A.C.G.I., A.M.I.E.E.

Mr. Stanley is with the British Standards Institution

IT is sometimes said that standardisation stultifies progress. That may be true if procedure is along the wrong lines, but as a generalisation it gives quite a false impression. While it would perhaps be going too far to say that progress in instrument and meter design has been brought about mainly as the result of standardisation, it can be asserted that progress and standardisation have for many years been running neck and neck, sometimes the one and sometimes the other being in the lead.

A study of the British Standard Specifications for meters and instruments issued during the last thirty years enables one to trace the progress in design, or rather performance, achieved during that period. In 1903 the Sectional Committee on Electrical Plant of the Engineering Standards Committee (as the British Standards Institution was at that time entitled) appointed a Sub-Committee on Electrical Plant Accessories under the chairmanship of the late Mr. C. H. Wordingham. One of its first acts was to invite manufacturers' evidence on "electrical supply meters," and it also sought the views of "central station engineers" on accuracy. Finally, in July, 1907, the main Committee of the E.S.C. adopted a form of standard specification for consumers' electric supply meters (motor type for continuous and single-phase AC circuits) published as Report No. 37.

The Sub-Committee then turned its attention to ammeters and voltmeters. First it issued a list of questions to manufacturers in order to gather reliable information on which to base recommendations. The preface to the specification eventually published in 1909 as Report No. 49 records that "the question of accuracy has necessitated prolonged discussion on account of the inherent differences between the various types of instruments as well as the degree of accuracy attainable under practical working conditions, and of the difficulty of expressing the permissible limits of error, when decided upon, in a simple manner." While recognising the importance of "dead-beatness" in instruments the Committee was unable to recommend a definition of the possibility of an instrument being made "dead beat" at the expense of the control involving inaccuracy due to friction. This reference to friction is particularly interesting in view of the latest amendment to the specification, mention of which is made later.

Standardisation, if intelligently applied, is not a brake on progress. Indeed, the author claims, it may help considerably to improve design and operation as the development of instrument standardisation has proved

The specification for meters has retained the reference number 37 throughout all its six editions, issued respectively in 1907,1915, 1919, 1929, 1930 and 1937; but that for ammeters and voltmeters was later superseded by Nos. 89 and 90, dealing respectively with indicating and recording instruments. No. 89 was first issued in 1919; it underwent revisions in 1926, 1929 and 1937, and a war emergency revision slip has just been issued. No. 90 was first issued in 1919 and revisions appeared in 1927, 1929 and 1940.

Electricity Meters

From their earliest days electricity meters have been the subject of legislation, and the limits of error have been laid down by the Board of Trade. Meter types have required official approval and, during the last few years, the testing of every individual meter has been compulsory. There is in practice a very close connection between these legal requirements and the B.S.S. for meters, the latter forming the basis of the approval of types and certification.

Many discussions have taken place on such subjects as the form of the registering mechanism. The pointer *versus* cyclometer controversy raged furiously for years. The 1907 edition dealt only with sizes up to 100 A. By 1915 it had become necessary to extend the range up to 5,000 A which was the upper limit of size until 1937, when it was further extended to 6,000 A. The 1907 specification dealt with the motor type for DC and single-phase AC meters. The 1915 edition covered three-wire and three-phase meters, but still excluded electrolytic meters, and certain of its clauses presented difficulty, which led to several changes.

No differentiation had been made between AC and DC meters, but by 1919 the Committee recognised that AC meters could be obtained having considerably greater accuracies than in the case of DC meters. It still felt, however, that it was illogical to require smaller error in one class than in the other, and it was not until 1929 that discrimination between them was made as regards the limits of error. A further innovation in the 1929 edition was that two grades of meter were recognised according to the degree of accuracy which they purported to possess, known as "substandard," and "commercial" respectively. The 1930 edition differed from that of 1929 only in that it included diagrams of connections, and in the following review of the performance requirements the 1930 edition is therefore neglected.

In the 1937 edition the commercial grade was sub-divided so as to include "long-range" meters, these being whole-current single-phase meters with a capacity up to twice the marked current. They are required to be distinctively marked on the name-plate by the letters L.R. The 1937 edition was also the first to recognise meters designed to operate over a range of voltage instead of at one particular voltage only. For such meters, however, the minimum voltage must not be less than 80 per cent. of the maximum.

Speed of rotation.—The speed of rotation was mentioned for the first time in the 1915 edition, when the maxima were given as 100 RPM for DC and 60 RPM for AC meters. Since that time there has been a tendency for the speed of DC meters to increase and that of AC meters to decrease; in 1929 the maximum of AC meters was reduced from 60 to 50 RPM and in 1937 that of DC meters was increased from 100 to 120 RPM.

Minimum Running Current.—The 1907 specification required that the meter should start and continue running steadily when a current equal to 1 per cent. of the capacity of the meter with a minimum of 1/10th A traversed the main circuit for a period of not less than five minutes. This time limit was dropped in the 1915 edition and the smallest minimum was reduced to 1/20th A. In 1929 the minimum running current was reduced to 0.5 per cent. of full load and the proviso that the minimum need never be less than 1/20th A applied only to DC meters.

Power Loss in the Pressure Circuit.—The 1907 specification prescribed that the total power spent in the pressure circuit should not exceed 4 W for each 100 V. In 1915 this was reduced to 2 W per 100 V, but there was no restriction for meters the full load of which exceeded 12.5 kW. In 1919 a distinction was made; for DC meters the maximum permissible loss was 5 W for 250 V meters, and 2 W per 100 V for meters marked above 250 V. These figures have remained unaltered since 1919, except that the dividing line was altered in 1929 from 250 to 230 V. For AC meters marked up to 250 V the maximum permissible loss in the pressure circuit was 2 W in 1919, and reduced in 1929 to 1.8 W for meters marked up to 230 V. For meters with higher marked voltage the maximum permissible loss has been 1 W per 100 V since 1919.

Power Loss in the Meter Current Circuit.—The 1907 specification prescribed that the total loss of power at full load in the main circuit of the meter should not exceed 15 W, subject to the further restriction that the voltage-drop in the main circuit at full load should not exceed 2 V. The loss was reduced in 1915 to 10 W, the drop remaining at 2 V. In 1929 differentiation was made; for DC meters the maximum permissible loss was 5 W and the drop was reduced to 1 V. For AC meters the drop was

limited to 1 V and the loss to 2 W for meters marked up to 10 A and 3 W for those marked from 10 up to 50 A. In 1937 these two figures were further reduced to 1.5 and 2 W respectively.

Limits of Error.—In the early days things were fairly simple, and the 1907 specification merely stated that the limit of error should not exceed 2½ per cent. for any load from full down to 1/10th. At any part of the range below that down to and including 1/20th of full load the percentage error had to be smaller than the figure which would be obtained by dividing by four the denominator of the fraction expressing the proportion the load bears to the full load. In other words, at 1/Nth of ful load the error was limited to N/4 per cent.

The error at loads down to 1/10th was reduced in 1915 to 2 per cent. and at 1/20th load 5 per cent. was permitted for meters having loads up to 1.25 kW. For greater loads the 2 per cent. error applied at all loads down to 1/20th full load. In 1919 a distinction was made between meters with and without external shunts, or transformers, and limits of error were 2.5 and 2 per cent. respectively from full load down to 1/5th ; thence down to 1/10th load the limits were 2.5 and 2.5 per cent. respectively, and at 1/20th load 5 and 4.5 per cent. respectively.

In 1929 a distinction was made for the first time between AC and DC meters, and for purposes of comparison with the earlier specifications I will here confine my attention to the commercial grades. For AC meters the limits of error down to 1/5th full load (at any power factor from 1.0 to 0.5) remained the same as in 1919 except that they applied also at 125 per cent. of full load. This is the first time that power factor has been mentioned. From 1/5th to 1/10th load at unity power factor the limit for meters without external shunts or transformers was reduced from 2.5 to 2 per cent. and at 1/20th load the limits both with and without external shunts or transformers were reduced to 2.5 per cent. For DC meters (commercial grade) the limits from 125 down to 10 per cent. of full load were 2.5 and 2 per cent. according to whether marked for below 10 A or 10 A and over, respectively.

In 1937 the distinction between meters with and without external shunts or transformers was dropped and a single limit of 2 per cent. applied to all (except long-range meters) from 125 down to 5 per cent. of full load at unity power factor. A limit of 2 per cent. also applied from 125 down to 20 per cent. of full load at 0.5 power factor. At 10 per cent. full load and 0.5 power factor a limit of 2.5 per cent. was allowed. For DC meters the limit remained the same as in 1929.

" Long range " meters are required by the 1927 specification to comply with the above mentioned limits, and in addition there shall be an error of not more than 2 per cent. for loads of 125 to 200 per cent. of marked current at unity power factor, and an error of not more than 2.5 per cent. over the same load range at a power factor of 0.5 (lag).

Voltage, Frequency and Temperature Variations

Variation due to Change of Voltage.—The 1907 specification prescribed that a variation of 10 per cent. above or below the marked voltage must not cause an error in respect of such variation of more than 1 per cent. No mention was made of the loads for which this stipulation applied. In 1915 the same variation applied at any load from full to one-tenth. In 1919 the voltage variation to cause a change of 1 per cent. in the rate of registration was reduced to 5 per cent. In 1929 the 5 per cent. variation in voltage was retained for DC meters, but for AC the 10 per cent. was reverted to.

Variation in Frequency.—A variation of 5 per cent. above or below the standard frequency must not, according to the 1907 specification, cause an error in respect of such variation of more than 1 per cent. In 1915 the same stipulation was made, but this time it applied at full load. In 1929 it was prescribed that a 5 per cent. variation in frequency should not cause a change in the rate of registration greater than 0.5 per cent. at unity power factor and 1.5 per cent. at 0.5 power factor. These limits were apparently on the tight side, for in 1937 they were increased to 0.75 per cent. at unity and 2 per cent. at 0.5 power factor.

Variation due to Air Temperature.—The 1907 specification simply prescribed that when the label on the meter stated the temperature coefficient all tests for accuracy must be corrected in accordance therewith to the standard temperature. In 1915 it was prescribed that if the rate of registration changed more than 0.1 per cent. for a change of air temperature of 1°C. the temperature coefficient must be marked on the label. The clause was made more specific in 1929 when it was prescribed that no meter, except the small DC mercury type, should have a greater temperature coefficient than 0.2 per cent. per °C. For certain specific types smaller temperature coefficients were mandatory ; for instance, for AC induction meters at unity power factor and DC mercury meters for 100 A and above the temperature coefficient must not exceed 0.1 per cent. per °C, and for AC induction meters at 0.5 power factor (lag) the coefficient must not exceed 0.15 per cent. per °C. These values remained the same in the 1937 edition, except that the 0.15 per cent. per °C. for AC induction meters at 0.5 power factor was reduced to 0.1 per cent. per °C.

Sustained Accuracy.—The 1907 specification required that if at any time within one year after the date of delivery the error were found to exceed the prescribed limits the manufacturer should at his own expense adjust the meter to register within the prescribed limits. In 1929 the clause was extended to require that the meter must maintain its accuracy within the prescribed limits for one year after calibration and, in addition, must comply with all other requirements of the specification for a period of three years.

Indicating and Recording Instruments

The original Report No. 49 (1909) applied only to ammeters and voltmeters, and consisted of 17 clauses and an appendix. When it was revised in 1919 the specification for indicating instruments (B.S. 89) was extended to cover ammeters, voltmeters, wattmeters, frequency meters and power-factor meters, and the latest edition (1937) contains 38 clauses and five appendices. The corresponding specification for graphic (recording or chart-recording) instruments is B.S. 90, which runs to 35 clauses and six appendices. Owing to the large number of types of instrument covered by these specifications it is not practicable briefly to trace the progress of the individual characteristics as has been done above for meters. The number of types of instruments dealt with, however, gives some indication of the growth of this family of instruments.

In 1909 there were three grades, " sub-standard," " first grade " and " second grade," and a single limit of error was specified for each grade. In 1937 the second-grade instruments were dropped, an indication that industry in general has appreciated the desirability of having accurate instruments for all and of the possibility of producing first-grade instruments at prices which offer no inducement to purchase second-grade.

In 1926 the specification for indicating instruments recognised four different types of first and second-grade voltmeters, three types of ammeter and four types of wattmeter, each type requiring its own limits of error. In 1937 the table of limits of error for first-grade instruments provided for eight types of voltmeter, seven types of ammeter and four types of wattmeter. The most interesting feature of the 1937 edition is perhaps the introduction for the first time of the rectifier-operated type.

The most spectacular improvement revealed in the various editions of B.S. 89 is in the accuracy of frequency meters. In 1919 the permissible error was 1 per cent. of the value of the reading of the middle point of the scale. A variation of 10 per cent. from the rated voltage was required not to cause a change in the indication of more than one scale division. In 1926 the change in the indication caused by a 10 per cent. voltage variation was altered to 1 per cent. of the mean scale value ; that is, a change of half a cycle for a mean scale reading of 50. These values remained unaltered in the 1929 edition, but in 1937 an entirely new class of accuracy was provided for by the inclusion of a " short-range " frequency meter, the range of which does not exceed four cycles. The error of this type is limited to 0.1 per cent. of the middle reading, and a 10 per cent. voltage variation must not cause a change in the indication greater than 0.05 cycle. This type of meter, in short, has errors about one-tenth of those previously allowed. It was introduced at the time when synchronous clocks were rapidly coming into popularity.

Graphic Instruments

A graphic frequency meter of the same high accuracy was introduced into the 1940 edition of B.S. 90, which marks an appreciable advance in the accuracy of graphic voltmeters, and an instrument having a maximum error of 1 per cent. is included. It is, in fact, comparable as regards accuracy with a first-grade indicating instrument. Rectifier-operated graphic ammeters and voltmeters and iron-cored electrodynamic graphic wattmeters were included in the specification for the first time in 1940, and requirements covering the use of synchronous motors for driving and timing the charts were added.

(*Continued on next page*)

Factory Lighting

Special Wartime Considerations

By J. S. Dow

THE issue of the now familiar "Fifth Report" of the Departmental Committee on Lighting in Factories has since been followed by draft regulations based thereon, which were due to become operative after the prescribed period (forty days from October 15th, 1940). To bring the lighting of factories up to the standards laid down is, however, a considerable task which might well occupy years—even if only those factories working more than forty-eight hours per week and engaged on work of special national importance are considered. In the circumstances it is inevitable that the regulations should be simple and clear cut.

It may be well to summarise, briefly, these regulations. They are concerned with (i) values of illumination and (ii) avoidance of glare, though there is also a general requirement that shadows causing eyestrain or risk of accident should be prevented. A minimum general illumination of (*a*) 6 ft.-candles in working areas and (*b*) 0.5 ft.-candle in other interior parts of factories where employees pass is demanded. The value of 6 ft.-candles is intended for ordinary work and is without prejudice to the higher values which are necessary for specially fine processes.

It would evidently be a counsel of perfection to expect 6 ft.-candles over every inch of the working area of every type of interior. Some latitude is therefore allowed in cases where the mounting height of sources exceeds 25 ft. or where the structure of the room prevents the uniform attainment of this standard, a minimum general illumination of 2 ft.-candles, with 6 ft.-candles at the point where actual work is done, being admitted. (Exemption is also granted for certain scheduled types of establishments termed "factories" such as gas and electricity works, cement works and glass works.)

In this article Mr. Dow, an acknowledged authority on the subject, refers to the recent regulations for factory lighting and gives some attention to many factors which have to be considered in their application

The requirements with regard to glare are those previously stated in the Fifth Report, ensuring in general a "cut-off" of 20 deg. at the eye when the brightness of fittings exceeds 10 candles per sq. in. and the mounting height is less than 16 ft. above floor level, and requiring the complete screening of local lights from the eyes of workers using them. The adoption of methods of preventing discomfort or injury by the reflection of light from smooth or polished surfaces into the eyes of the worker is also demanded. There is likewise a general requirement in regard to the prevention of shadows causing eyestrain or risk of accident.

To an onlooker reviewing recently proposed legislation on factory lighting one point may well excite surprise—that the Fourth Report of the Departmental Committee should have been followed within two years (and before it actually became operative) by a Fifth Report demanding much higher values. The minimum illumination required in working areas (6 instead of 1 ft.-candles) might appear at first glance to be multiplied no less than six times. It should be pointed out, however, that the higher value is at floor level and the lower at the working plane.

There is, however, justification for this step. In the first place the "1 foot-candle" was not regarded exactly as a *working illumination*, but rather as a minimum general value, on which the specific working illumination, depending on the task, should be superimposed. The "6 foot-candles" is something different. It is definitely regarded as a working illumination, for ordinary working processes, though it still remains true that for many forms of exacting work and for specially fine and intricate processes very much higher values of illumination are desirable. An indication of the range of such values, involving illuminations up to 50 ft.-candles or more, is found in the "Recommended Values of Illumination" of the Illuminating Engineering Society.

In the second place it must be clearly understood that the Fifth Report deals essentially with war conditions. These conditions are abnormal in at least two respects, namely, because of the much greater effort and longer working hours frequently imposed, and because work in many factories is conducted mainly or even exclusively by artificial light. A helpful analysis of these factors is to be found in Mr. H. C. Weston's recent paper before the Illuminating Engineering Society.

These higher values of illumination, coupled with absence of glare, which form the main subject of these Regulations will facilitate work in factories. But they tell only part of the story. The various recommendations issued by the Ministry of Labour in connection with the Regulations contain helpful explanatory matter, especially in regard to the value of light surroundings and access of natural light during daylight hours. In the Fifth Report stress was laid on both these factors. (It is perhaps a pity that the definite recommendations proposed in this report in regard to the maintenance of light colours for surroundings which are less than 20 ft. above floor level has been abandoned. Apparently there were difficulties in bringing this condition within the Factory Act.)

Anyone having any considerable experience of visits to blacked-out factories during the daytime will confirm the remarks on both these points. The mere fact that there is bright daylight outside no doubt affords another reason why a high value of illumination within the factory is desirable. It has, for example, been estimated that with an interior illumination of

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Instrument Design (*Concluded from page 255*)

The latest development is, in a sense, a retrograde step, but will be of a temporary nature only. A "war emergency revision" has just been issued which has the effect of increasing by 100% the permissible limits of error in first-grade ammeters, voltmeters and wattmeters. This increase applies to instruments fitted with substitute bearings, the use of which has been brought about by the present shortage of jewel bearings. Owing to the effect of pivotal friction with substitute bearings, light tapping of the instrument is permitted during all tests. The introduction of substitute bearings has made it necessary for the instruments to be worked in some way, and the revision slip to B.S. 89 standardises the marking in the form of the letters J M G for jewelled, metal and glass bearings respectively.

Instrument Transformers.—The first B.S. for instrument transformers appeared in 1919. The progress in design as reflected by the differences between the 1919 and 1927 editions were insignificant as compared with the improvements incorporated in the 1936 edition. The four classes of current transformer in the 1927 edition are retained in the 1936 edition, their limits of error being substantially unchanged and the ratio error of the most accurate class being 0.5 per cent. at rated current. Five new classes have been added, and the ratio error of the highest accuracy class is 0.15 per cent. at rated current. The phase error of this class is three minutes at rated current as compared with 35 minutes which was the smallest phase error in the 1927 specification.

Another important new feature of the 1936 edition was the introduction of over-current ratings. A rated over-current factor is required to be assigned to the transformer by the manufacturer, such that the rated primary over-current is equal to the product of the rated primary current and the rated over-current factor. If a current equal to the product of the rated primary current and the rated over-current factor be passed for the rated time through the primary of the transformer, the secondary of which is connected to the rated burden, the temperature-rise must not exceed 200° C. in any part of the transformer.

As regards voltage transformers, the four classes of the 1927 specification are retained in the 1936 edition, the ratio error at rated voltage of the highest accuracy class being 0.5 per cent. Two new classes have been added, one of these having a ratio error of 0.25 per cent. and a phase difference of 10 minutes as against 20 minutes for the highest-accuracy class in 1927.

5 to 10 ft.-candles something like 15 to 20 minutes is necessary for the eyes of those entering from bright sunlight outside to become adapted to the inside conditions. But the mere provision of an exceptionally high degree of artificial lighting is not in itself a complete cure. When the high illumination on the work is combined with obscurity overhead there may still be a sense of oppression, which the presence of light surroundings and, where possible, an illuminated ceiling does much to dispel.

When, in inspecting a large factory, one passes from completely blacked out regions to areas where natural light is admitted there is almost always a sense of relief. The mere presence of some natural light is reassuring. The mingling of natural diffused light with direct artificial light is almost always an advantage. One says "almost" because cases do arise when the injudicious entry of natural light is harmful.

It is important, therefore, to secure that admitted daylight is distributed with a reasonable degree of uniformity. During periods of sustained bright sunlight it is often expedient to soften natural light by the use of white blinds or similar diffusing devices. So long as the light is evenly distributed, admitted natural light usually blends well with artificial light. The mixing is, of course, particularly successful when the recently introduced fluorescent tubular "daylight" units are adopted.

As an indication of the amount of daylight that can be admitted, uncovering windows to the extent of 12 per cent. of the floor area is recommended. Even a smaller fraction is, however, beneficial. In my own experience the benefits of admission of daylight fully justify the expense and trouble involved in the installation of adjustable shutters and the like, apart from the advantage of providing some ventilation.

Quality as well as Quantity

There are many considerations that might be mentioned to illustrate the difficulty of defining *exactly* what is involved in good industrial lighting. The "Recommended Values of Illumination" of the Illumination Engineering Society, quoted in the Fifth Report, form an excellent basis of action so far as *quantity* of light is concerned. But it may well be suggested that they would become even more valuable if supplemented by some guidance in regard to *quality*. Regulations and schedules of foot-candles only partially convey what is desired. It must be constantly remembered that regulations necessarily ask for *less* than many illuminating engineers would wish to provide and enterprising and prosperous firms would willingly install. The requirements in regard to glare, for example, should serve to prevent the worst abuses. But in the Fifth Report it was advised that, even in the case of sources mounted at heights exceeding 16 ft., care should be exercised and the use of brilliant unscreened sources avoided. Indeed, at this stage of illuminating engineering it is not unreasonable to ask that filaments should never, under ordinary conditions, be visible to the operator.

Again whilst the evil of direct glare, in the form of light from sources entering the eye of the worker, is now fairly generally accepted, indirect glare, in the form of light reflected into the eyes from polished or shining working material is much more widespread and the cause of much more discomfort than is generally understood. One instance is the glitter from freshly cast printers' type, which has already led to the use of indirect lighting or of low-brightness units of extensive area. Mr. R. Maxted, in a recent paper before the Illuminating Engineering Society has emphasised the benefits of this form of lighting, which has the combined merits of diminishing direct and reflected glare, softening shadows and producing a more pleasing effect.

It is significant that the tendency towards higher values of illumination in itself favours this departure. In the United States when general illumination up to 50 ft.-candles or more became usual, it was quickly recognised that the source of light must be spread over a more extensive area; otherwise the glare would become intolerable. Hence the return of indirect lighting or the substitution of equivalent methods of securing low overhead brightness.

Even this mode of lighting, however, cannot be regarded as a panacea. There are processes which involve the recognition of regularities of surfaces or fabrics and which demand light coming from one direction only, though possibly supplemented by general diffused lighting of lower value. There are also processes so exacting and requiring such an exceptionally high illumination that local lighting (again superimposed on general lighting of a lower order) is the only real solution. Some of these processes are concerned with the manipulation of minute parts. Others involve examination of very dark materials which reflect but little light. My belief has always been that material of this nature requires local lighting with relatively subdued illumination of surroundings.

The mode of lighting most suitable for the majority of industrial operations—diffused general lighting with light coloured surroundings—is in this case unsuitable. It has the drawback of producing a surround many times brighter than the work itself—a condition of "reversed contrast" which inevitably causes the material to appear underlighted. Such local lighting invariably needs to be supplemented by diffused general lighting of lower value. Local lighting is, however, often the dominant feature of the system. It requires quite as much study with regard to direction of light, shadow conditions and absence of glare as does general lighting. Elimination of glare is indeed of special importance in view of the close proximity of the light source to the eye. This source should be *completely* screened from direct vision, and the position of the light should be selected with a view to minimising reflected glare.

Revealing Detail

Low and even brightness of the light source, which forms such an important element in diminishing glare, often plays a considerable part in revealing detail, especially when the material is of a highly polished nature. An extensive luminous area of even but moderate brightness, of which a reflected image can be readily obtained, forms the basis of standard methods of examining sheets of polished metal for minute defects. Lighting of this type is of the greatest assistance in the reading of divisions and figures on polished scales, verniers, etc.

Close inspection of manufacturing processes may reveal other special lighting fittings. It was recently stated in the *I.E.S. Lighting Review* (Australia) that a combination of two fluorescent tubular sources, one green and one daylight, had been found ideal to facilitate the marking of steel with sharp tools as a guide for punching. Many other unusual arrangements, adapted to special trades, could be mentioned. In such cases it is frequently not the illumination on the work but the reflected image of the source, or it may be the effect of transmitted light, that is the most important consideration.

Enough has been said to show the complexity of the factors underlying industrial lighting and the difficulty of prescribing general rules applicable to all possible cases. In presenting the regulations the Ministry of Labour did well to refer readers to the National Industrial Electric Lighting Service and the corresponding Committee of the Institution of Gas Engineers, for expert advice. The urgency of the problem of meeting the demands of the large number of factories involved is evident. In completely new or recently designed works, engaged on vital national tasks, it should be the aim to furnish the finest lighting that can be devised, both as regards the value of illumination in foot-candles and the quality of light adapted to the process.

In factories of longer standing, more especially those in which the lighting was planned many years ago, fundamental treatment is hardly possible. All that can be expected is to bring the lighting as near as possible to standard conditions. It is in the case of the large number of smaller factories, to which Sir Duncan Wilson has recently referred, that the problem is likely to prove most difficult and considerable skill in improvisation will here be necessary.

If by various means the general standard of lighting in important factories throughout the country can be raised as a whole to a higher standard, a most important contribution towards increased national effort will have been taken.

Future Industrial Lighting

Finally, illuminating engineers, whilst of necessity applying standard methods and improvisation to meet this emergency should apply a corner of their minds to the study of the ideal industrial lighting of the future. Here *quality* may well play a more dominating part. The attention recently devoted to the effect of surroundings is also significant. for we are now approaching a period when there will be less distinction between "industrial lighting" and other forms of lighting than in the past.

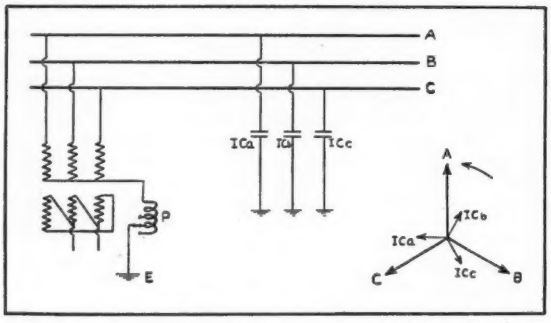
The neater design and greater cleanliness of the factories of to-day makes possible methods of lighting approaching more closely to those in offices, shops and even places of entertainment. The human standpoint and the psychological reaction of workers to their lighted environment may prove to be quite as important as the direct influence of the lighting on the actual industrial operations.

Arc-suppression Coils

A Diagrammatic Representation of the Petersen Principle

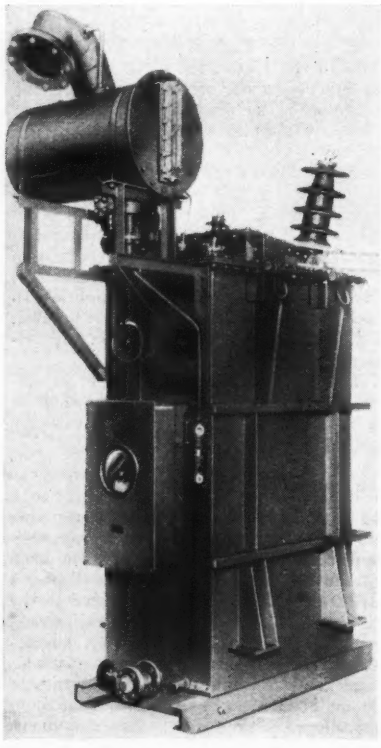
STATISTICS seem to show that well over 70 per cent. of all transmission line interruptions begin, at any rate, as faults to earth. There are also indications that at least 95 per cent. of all faults of this kind would be rendered harmless and so incapable of interrupting supplies if the initial insulation arc-over were suppressed quickly enough to effectively guard against any appreciable follow-through of power current.

The general adoption of arc-suppression coils would eliminate nearly three-quarters of all transmission line interruptions



Diagrammatic representation of arc-suppression coil with vector diagrams (above) I (*a*) for "healthy" line and (right) I (*b*) with an earth fault on one phase

Arc-suppression coils of the Petersen pattern are in many cases capable of doing this effectively. The principle involved is a simple one. Diagram 1 (*a*) represents a transmission line in the normal state. There are the small capacity currents ICa and ICb and ICc, the resultant of which is zero when added vectorially so that no current normally flows in the earth connection in series with which is connected the arc-suppression coil P, consisting of a tapped reactance of special design.

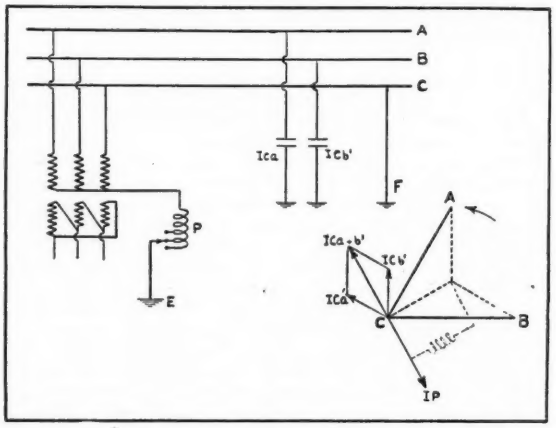


Petersen coil in oil tank with (above) conservator and (on side) off-load tapping switch

Suppose that an earth fault F occurs on phase C, the conditions will then be as represented in fig. 1 (*b*). The phases A and B will be raised to the full line voltage above earth so that their capacity currents (ICa and ICb) will correspondingly increase to $\sqrt{3}$ times their previous value, while there will not be any capacity current ICc, since phase C will be at earth potential. The capacity currents will no longer amount to zero by vectorial addition, but will be as shown (*i.e.*, approximately three times the value of one phase normal capacity current).

The arc-suppression coil is so designed that this capacity current is of the same magnitude as the reactive current which flows through the coil. due to the earth fault on the line, but 180° out of phase with it The vectors in fig. 1 (*b*) show that the resultant of the capacity currents (ICa and ICb) is equal and opposite to the reactive current (IP) so that no current would then flow through the fault. Actually this ideal condition is never fully realised owing to the fact that the capacity and reactive currents are never quite at zero power factor due to certain extraneous losses, such as corona and leakage and the loss components of the arc-suppression coil. However, the variation is slight and is never sufficient to allow the actual earth-fault current to reach a value which will permit a sustained or destructive arc.

The value of this residual current can be varied by tuning the reactance. The coil is provided with a small range of tappings for this purpose, the tapping being selected to give the lowest



residual earth current. Tuning is normally carried out by the makers on installation of the coil, but it is essential to check it from time to time by means of an ammeter in the earth circuit under artificial fault conditions, the tapping being selected to give the lowest reading. The setting will vary according to the total impedance in circuit in the system.

This tuning of the arc-suppression coil results in a resonant condition of the circuit under fault conditions which constitutes a further important advantage. In the case of transient faults (such as arcing earths due to swinging conductors, etc.) the resonance of the circuit causes the line-to-earth potential to be re-applied at the fault in a gradual manner after the fault has cleared, the recovery of voltage taking up to one second or so, and the residual earth fault current dying out slowly, by reason of the damping of the resonance by the ohmic resistance of the earth circuit. The delay thus caused in the re-establishment of the full potential allows the ionised air caused by the initial arc to disperse and in this way lessens the likelihood of the arc re-striking.

In rating there are two alternatives: either to rate for only a short period (say five minutes) under fault conditions and to switch out the faulty line after a few seconds delay; or to have the coil continuously rated and to allow the line to remain alive with one phase earthed until it is convenient to repair it.

In the first case the arc-suppression coil would be shunted by a short-circuiting switch operated by a relay having a time delay of several seconds. This would allow the coil to clear any transient faults without interruption, while if a sustained fault occurred the short-circuiting switch would cut out the coil and allow normal Merz-Price protection to isolate the faulty section.

In the second case Merz-Price balance protection would not

operate, since the fault current would be reduced to a value insufficient to operate the relays in order to maintain continuity of supply. In the event of a second earth fault developing and causing a phase-to-phase short circuit the Merz-Price system would of course operate, but some method of indicating the presence of an earth fault is necessary, for in the absence of any warning such a fault might exist almost indefinitely without being noticed.

In general where a duplicate supply is available, on ring-main systems for example, it is preferable to install a short-time rated coil. Immunity from interruption due to transient faults is achieved by this method and it is worth while for this alone particularly in the case of overhead lines. Otherwise it is permissible to use a continuously rated coil and allow persistent faults to remain in circuit until it is convenient to cut off the supply; indeed this has been done on occasions with a dead earth on one phase and no damage whatever has resulted, because the residual earth current which flows is so small. But if interference with telephone lines is likely, the short-time alternative will have to be adopted. Co-operation with the Post Office authorities is always advisable in such cases.

The calculation of the size of coil required is somewhat complicated, since it depends upon the capacitance to earth of the whole system to be protected. This can be determined from statistical data on the characteristics of the cable used and the height, spacing, sags, etc., of the overhead lines, but allowance must be made for the self-capacitance of apparatus connected, for adjacent buildings and other factors. In view of these extraneous influences, it is generally preferable to determine the capacitance by actual experiment.

This may be done section by section. Each section in turn is energised from an independent transformer, or generator operating with unearthed neutral. An artificial earth-fault is applied in turn to each phase and the current flowing in the fault is measured by means of an ammeter. Sections having an earth capacitance current of up to 5 A have been found to be convenient units. By this method any out-of-balance of the capacitances is shown up and can be remedied by transposition of conductors, or other means.

The construction of the arc-suppression coil is based upon oil-immersed transformer practice, comprising a single winding on a "Stalloy" core of special design. A small auxiliary potential winding may be included when required for such purposes as operating a shunted circuit-breaker, or for energising an indicating or recording meter. The latter is a useful accessory, since it gives a graphic record of the number of faults which have been cleared by the arc-suppression coil.

Many arc-suppression coils are in operation in various parts of the world, although their use has not yet become widespread in England. One maker is the Hackbridge Electric Construction Co., Ltd. Only one high-voltage terminal is necessary, the other being a lightly insulated earth terminal. Other fittings shown in the illustration are the conservator tank, explosion vent, silica gel breather, the handwheel of the off-load tapping switch (for tuning the coil) and the recording ammeter mounted in a steel case on the side of the tank.

NEW BOOKS

Design of Electrical Apparatus: Second Edition. By Professor J. H. Kuhlmann. Pp. 506; figs. 261. Chapman & Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 30s.

The first edition of this book on the design of electrical apparatus—which here means machinery—appeared ten years ago. The general plan remains unaltered, but new methods and designs, including fractional horse-power motors, have been added.

On the first page we learn that the non-commutating-pole machine is practically obsolete. For the sample DC designs the author has chosen a 300-kW, 900-RPM, 230-V compound generator, and a 15-HP, 1150-RPM,230-V motor. Both are calculated in detail. For synchronous machines the author designs a 2,500-kVA, 225-RPM, 2,400-V generator and a 200-HP, 900-RPM, 440-V motor, each 3-phase, 60-cycles. Synchronous machines lend themselves more readily to analytical treatment than DC machines. Even so, the author's methods are inclined to lean to the empirical side. In all cases much valuable constructional and design data are given.

Coming to induction motors, here, too, some of the earlier empirical work could be replaced by later analytical methods. The method of estimating the ampère-turns for the air-gap is not one that we should recommend, though it has to be remembered that most designers have their pet methods, which they are able to use with at least as close accuracy as the shops are able to work to. The worked designs for 3-phase, 60-cycle current are: 15-HP, 6-pole, 220-V, squirrel-cage; and 400-HP, 14-pole, 2,000-V, slip-ring.

There is a useful chapter on single-phase, fractional-horse-power motors. The comparatively large secondary effects in these small machines makes accurate design troublesome, and many will consequently appreciate the calculation of a ¼-HP, 110-V, 1,725-RPM, split-phase motor with its special stator winding; and of a ½-HP capacitor-start motor. The latter is to be built by the engineering students at the Minnesota Institute of Technology.

The remainder of the book is devoted to transformers. A useful discussion on modern construction is given and the author calculates a 400-kVA,single-phase, 42,000/2,400-V, core-type transformer; a 1,000-kVA,3-phase, 7,960/575-V, core type transformer; a 10-kVA, single-phase, four-part distributed core type, 2,300/230/115-V transformer; and a 500-kVA, single-phase, 22,000/2300-V shell type transformer—all for 50-cycle current.

There is no doubt that the English designer who studies these American designs will be amply repaid, and as a specialist he will not be too much troubled by other methods, provided he sets about his task in the right way. The book is scarcely suitable for the college student unless he wishes to specialise in this branch of electrical engineering. To such, however, and the young designer, the numerous diagrams, detail drawings and photographs, will be very helpful. The wide range of designs, too, will assist in giving a proper conception of the influence of size on design constants.—S. P. S.

Plastics in Industry. By "Plastes." Pp. 240; 32 illustrative plates and 8 diagrams. Chapman & Hall, Ltd., 11, Henrietta Street, Covent Garden, London, W.C.2. Price 12s. 6d.

The title of this book is indicative of its object, which is to prime both industrialists who may be seeking fresh constructional materials as well as chemists and moulders who are anxious to widen the market opportunities for the substances they make. The first four chapters are concerned with definitions, differentiation between the properties of resins, specifications and moulding and fabrication technique. But most of the book is descriptive of applications, actual and potential, in many different light and heavy industries.

Types and grades of materials employed in the electrical industry are discussed (in 21 pages), advantages offered being briefly summarised and advice given on the machining of mouldings, which requires some care. Commercial varieties of the newer sheathing materials, in place of rubber on cables for example, are also mentioned. A final short chapter points out the influence of good design, which will help to sell the goods; usually representing a stage in gradual development rather than a radical change "ahead of its time" commercially.—W. O. F.

Mechanical World Year Book. Emmott & Co., Ltd., 31, King Street West, Manchester, 3, and also at 28, Bedford Street, Strand, London, W.C.2. Price 2s. net.

Revisions and additions have not altered the general form and handiness of the 1941 edition of this well-known work of reference. New tables and formulæ for various types of ball and roller bearings are intended to assist selection for definite service conditions. Another fresh section presents the advantages and limitations of several commonly used case-hardening processes. The section on machine tools is concerned chiefly with principles of design rather than specific types, while the information given on press work and electric arc welding should also be particularly helpful at the present time. Blank and squared pages have been substituted for the diary section.

Shorter Notices

House Telephones, Bells & Signalling Systems; Wiring Circuits for Lighting, Power and Electrical Control; Testing Electrical Installations & Machines; Factory Installation Work; Motors & Control Gear. Volumes 4-8 of the *Electrical Engineer* Series. General editor, E. Molloy. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 6s. each.

Works Boiler Plant. By F. J. Matthews. Pp. 184; figs. 88. Hutchinson's Scientific & Technical Publications, Paternoster House, Paternoster Row, London, E.C.4. Price 10s. 6d.

The Practice of Arc Welding. By W. Heigh. Pp. 114; figs. 79. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 5s.

Railway Signalling and Communications: Installation and Maintenance. Pp. 416; figs. 339 and plates. The Railway Gazette, 33, Tothill Street, Westminster, S.W.1. Price 8s.

COMMERCIAL AND INDUSTRIAL NEWS

Machinery Control Orders. New Battery Prices
Co-operative Export

Machinery Licences

THE Board of Trade draws the attention of manufacturers of machinery, plant and appliances and those wishing to acquire them, to an amendment of the Orders governing the sale or transfer of machinery and to the extension of the Orders to include additional machinery, plant and certain appliances. Section 4 (1) of the Machinery and Plant (Control) (No. 2) Order, 1940, has been amended to include electric motors exceeding 5 HP (including control equipment) within the scope of the Order. Electroplating machinery and plant are also now covered by the Order. Applications for licences must be made to the Industrial Supplies Department (Machinery Licences Division), Board of Trade, 25, Southampton Buildings, London, W.C.2.

Machine Tool Control

The Minister of Supply has made the Control of Machine Tools (No. 7) Order which provides that Orders Nos. 3 and 4 shall not apply to, or in respect of, sales or agreements or offers for sale of used machine tools by auction. It stipulates that no person shall sell or agree or offer to sell any used machine tools by auction, except under the authority of and in accordance with a licence granted or a special or general direction issued by the Minister of Supply. The expression "machine tool" includes any mechanical contrivance for cutting, forming, abrading, polishing or otherwise working wood or metal and any standard equipment usually sold therewith.

Exports to Eire

Shipment of goods from this country to Eire has been placed on the same footing as exports to other parts of the British Empire by the Export of Goods Control (No. 1) Order, 1941, which comes into operation on January 20th. This means that export licences will be required for all the goods marked "A" in the schedules of goods issued by the Board of Trade.

Engineering Advisory Branch

A new branch of the Ministry of Labour and National Service has been formed to be known as the Engineering Branch, to advise on engineering matters, especially in relation to the work of the Munitions Labour Supply Organisation. Mr. G. Stevenson Taylor, O.B.E., M.I.Mech.E., A.R.C.S., is to be in charge of the new branch.

Engineering Trainees

The Ministry of Labour and National Service announces that men are urgently needed now to fill the Government training centres where training is given for wartime work in the engineering industry.

An appeal for volunteers is being made to all men who have not yet registered for military service and are not in a reserved occupation or who have registered and have been placed in medical grades three or four; to men who have retired and to men who are over sixteen and under twenty years of age. Volunteers should apply to any employment exchange where full information may be obtained.

Torch Battery Prices

An Order has been made by the Board of Trade replacing the Dry Batteries (Prices) (No. 2) Order, 1940, under which maximum prices were fixed for imported batteries. This is the Dry Batteries (Prices) (No. 4) Order, 1940 (S.R. & O., 1940, No. 2168, price 1d.). Under the new Order new maximum prices are fixed for batteries imported from Hong Kong and the prices for batteries imported from countries other than the United States, Canada and Hong Kong are slightly increased. The prices fixed for imported batteries are as follows:—

	Class A. Batteries imported from the United States	Class B. Batteries imported from Canada	Class C. Batteries imported from Hong Kong	Class D. Batteries imported from other countries
	Maximum selling price per battery.			
Bijou or No. 216 ..	7d.	5d.	3½d.	4¼d.
Large Unit Cell, Large Mono or No. 2. ..	5d.	4½d.	3¼d.	4d.
Medium or Baby, Small Mono or No. 1 Unicel...	5d.	4d.	2½d.	3d.
Fountain Pen or Penlite Single Cell or No. 9 Unicel.	4d.	3d.	—	—
Fountain Pen or Penlite 2 Cell..	8d.	6d.	—	—

These prices do not include Purchase Tax; the permissible addition where tax has been paid is ½d. on a battery costing 2½d.; ¾d. on a battery costing 3d. or 3½d.; 1d. on a battery costing 4d. or 4½d.; 1¼d. on a battery costing 5d. or 6d.; 1½d. on a battery costing 7d., and 2d. on a battery costing 8d.

Bridge Lighting in Australia

Fifteen months of black-out in the United Kingdom have caused us almost to forget that there is such a thing as public lighting. Its progress continues, however, in other countries. A new and interesting scheme within the Empire is that installed recently on Storey Bridge, spanning the Brisbane River, Queensland, Australia. Including the main span of 924 ft. and the approaches of 3,651 ft., the total length is 4,575 ft., making it the largest bridge in Queensland. Both span and approaches are lighted by "Philora" sodium lamps, 85W for the roadway and 60W for the footpaths, all of these being accommodated in E.L.E.C.C. "Golden Ray" refractor plate lanterns. This combination of lamp and lantern was finally decided upon by the authorities after very careful consideration of the needs of maximum efficiency and general effect, the results being a high degree of visibility, freedom from glare and economy in operating expense.

Messrs. William Adams, who designed the scheme and supplied the lighting equipment, have been congratulated by the Government authorities on the successful results. The "Philora" sodium lamps were supplied by Philips Lamps (Australasia), Ltd., and the "Golden Ray" fittings by the Engineering and Lighting Equipment Co., Ltd., St. Albans, through Messrs. William Adams, who are the sole agents for Australasia.

Storey Bridge, Brisbane River, lighted by "Philora" sodium lamps

Engineering Workers' Wages

Last week the National Arbitration Tribunal held a session in London to hear an application from the Amalgamated Engineering Union and the National Union of Foundry Workers for an increase of 3d. an hour. The unions' case was presented by Mr. J. Tanner, president of the A.E.U., and the employers' views were expressed by Sir Alexander Ramsay.

The Tribunal also heard an application by a number of other unions connected with the engineering industry for an advance of 10s. per week on time rates with corresponding increases in piece rates. Both matters were held in private and the Tribunal will announce its decision shortly.

Co-operation in Export

At a meeting of the Institute of Export last week, Mr. L. G. Adams dealt with the subject of co-operative arrangements as a means of increasing export trade. He referred to the recommendations of the 1929 Goodenough Committee on Education in Salesmanship and explained that co-operative selling meant the banding together of four or five firms which sold similar, but non-competitive, articles to the same class of buyer. He gave as an example of this kind of group the manufacturers of power station equipment.

The setting up of such an organisation spread the costs of the work over a number of firms; probably no one firm would be able to undertake the expense involved in market research, advertising, propaganda and, possibly, showrooms. Mr. Adams stressed the importance of the group representative being technically qualified for his position so that he would be able to discuss intelligently prospective buyers' problems.

He maintained that co-operative selling would not divert trade from the merchants but, on the other hand, by wise and qualified direction would increase the amount of business which they were able to do. As to the Export Group, quite a number of their members would require only service in the field of statistics, material and labour priorities, and general contact with the Export Council and Government Departments. But there were a great number in the groups who could, if organised on co-operative lines, play a very important part in the future development of British export trade.

Increased Responsibility in Wartime

After considering a proposal of the Electricity Committee for the regrading of an employee, the Manchester Corporation Establishment Committee, considered the question of payment of extra remuneration where officers are assuming increased responsibilities during absence of other officers on war service. The following resolution was adopted :—" That, having regard to the existing practice whereby officers undertaking increased duties and responsibilities in the temporary absence of senior officers do not, unless there are exceptional circumstances, receive extra remuneration, this Committee are of opinion that the same principle should be applied in the case of officers called upon to assume increased responsibilities in consequence of other officers undertaking war service."

Absence from Work

On January 3rd at Ealing Police Court, Hoover, Ltd., brought an action against Henry Frederick John Day, one of their employees. Mr. Reece in opening the case for the plaintiff company, stated that the action was brought under the Employers' and Workmen's Act (1875), and was a claim for damages in respect of the defendant's continued absences from work, thereby causing the plaintiff company to suffer certain damage. In the course of the evidence it was stated that Day was a highly skilled man engaged on important work and earning between £9 and £10 a week. He was exempted from military service on account of his work. During three extensive periods last year he absented himself without any explanation or medical certificate being tendered and his absence caused several machines to stand idle. Day did not appear and was not represented. He was ordered to pay £10 damages and costs on each of three summonses.

Lighting Catalogue

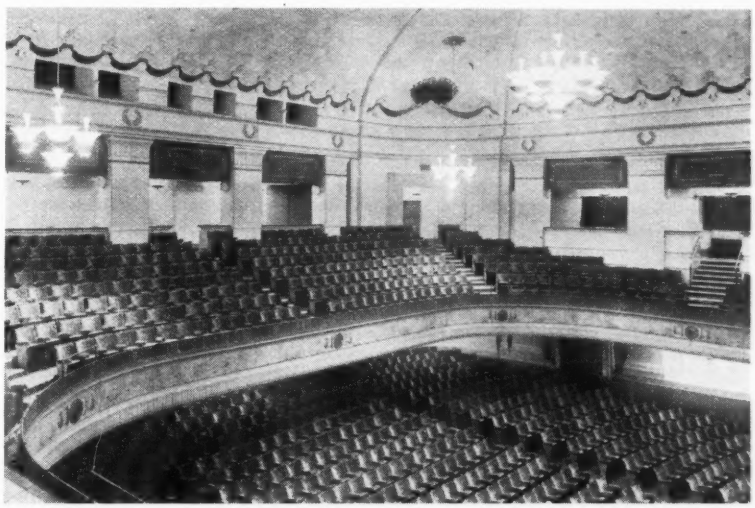
The latest illustrated catalogue (No. 4,000) produced by Holophane, Ltd., Elverton Street, Vincent Square, Westminster, London, S.W.1, is divided into two sections, respectively dealing with commercial and industrial lighting fittings. It incorporates all current lines, so being a complete and ready reference to all the various types of products available from this company. Prismatic means of controlling light are briefly explained and recommended degrees of illumination for many classes of buildings and kinds of work are included, together with technical data useful for purposes of calculation.

Bournemouth Pavilion Lighting

Owing to the possibility of breakage of glass through enemy action, all glazed lighting units in public buildings used for entertainment are required to be adequately treated to prevent consequent injury to persons. For the concert hall of Bournemouth Pavilion, the General Electric Co., Ltd., instead of using wire cages and guards or substituting expensive translucent fabric temporarily for glass, have designed glassless fittings for permanent use in harmony with their surroundings.

The fittings, suspended from existing points in the main ceiling and lighting the auditorium and balcony, consist of groups of uniform design, the centre fitting comprising a group of seven with four surrounding groups of four units each.

Each unit comprises two main spinnings built up on an interior structure. The centre lamp giving direct light is masked by the opaque lower spinning and from oblique vision by additional louvres in the opening at the bottom. The light from this lamp also illuminates the upper trumpet-shaped spinning which, in turn, accommodates a group of lamps throwing light on the ceiling. The under side of the balcony, and the promenade at the rear of the balcony, are illuminated by indirect lighting all-metal units.



G.E.C. lighting fittings at the Bournemouth Pavilion

The total wattage is equivalent to that of the original fittings ; intensity of illumination at seating level has been maintained with improvement in quality. The installation was carried out by V. J. Kitcher & Co., equipment being supplied through Kennedy's (Bournemouth) Ltd.

Trade Announcements

The General Electric Co., Ltd., announces that it opened on Monday last new premises, including a trade counter, at Lawford Street, Old Market, Bristol, 2 (telephone : 57867).

The address of A. E. Walker, Ltd. is now Imperial House, Dominion Street, South Place, London, E.C.2. The company can still supply goods from its factory. It asks for copies of inquiries, orders, invoices, etc. posted on and after December 27th.

Catalogues and Lists

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet (No. 887) brought up-to-date and new priced leaflet (No. 1106) which illustrate and describe " Reylovolt " step-down transformers for safe " portable " lighting at 25-V suitable for A.R.P. purposes.

B. E. N. Patents, Ltd., High Wycombe, Bucks.—Illustrated and priced leaflet descriptive of extension guns for spraying awkward surfaces, or interiors, such as cooling pipes on transformers.

Londex, Ltd., 207, Anerley Road, Sydenham, London, S.E.10.—List (No. 91) illustrating a roof spotter alarm system actuated by push-button relays.

Power House Components, Ltd., Albion Chambers, King Street, Nottingham.—Illustrated catalogue descriptive of "Wayne" self-winding electric cable reels, including heavy and light duty types.

Commercial Electrical Travellers' Lunch

The Electrical Trades' Commercial Travellers' Association will hold its annual lunch on February 7th, at the Connaught Rooms. The president, Mr. T. W. Heather, has promised to attend, as have also officials of other Associations connected with the electrical industry. Tickets (7/6d. each) can be obtained from the hon. secretary, Mr. S. Johnson, 78, The Ridgeway, Waddon, Surrey.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following :—

" FLASHTIGHT " switchgear (as used by the Admiralty).

" Rem. Russell, Electro Medical Ltd., London," present address or suppliers of equipment.

" STEIRO " washing machine (product of Vidrio Products, Chicago).

" LUGAN " watertight door switches.

TRADE MARK APPLICATIONS

AMONG recent applications for British trade marks are the following, objections against which may be entered within one month from January 1st :—

CATSEYE. No. 612,514. Class 11. Electric-lamp illuminating device for attachment to telephone instruments. — J. H. Bowden, 12, Beadon Road, Bromley, Kent.

MIPEX. No. 612,710. Class 17. India-rubber and ebonite sold in sheet form for industrial purposes. — Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester.

Assistance for Wholesalers

A Plea for the Unfortunates

By "Sala"

THIS article is a plea to manufacturers of electrical merchandise to give increased assistance to those electrical wholesalers who have been unfortunate enough to suffer damage to their stocks and premises by enemy action. The plea comes also from those wholesalers who have been more fortunate but whose premises are situated in industrial areas which have suffered and whose stocks of electrical equipment have been quickly cleared for use in the urgent work of repair and reconstruction in those areas.

It is appreciated that the number of special priority orders which are on his books does not make it easy for the manufacturer to satisfy the additional urgent demands for replacement of damaged stocks. His special priority orders are so numerous that they must take rotation for delivery and, in consequence, his output has already been planned to the last nut and bolt for many weeks ahead.

By examining his orders it is almost impossible for the manufacturer himself to decide which priority orders shall receive preference and at the same time judge the importance of the orders received through the regular trade channels which do not quote Government priority contract numbers. Those orders which represent vital replacements of damaged stocks are not likely to quote contract numbers and are, therefore, placed in the category of those which will take their turn for delivery after existing uncompleted priority orders have been fulfilled.

Wholesalers can play an important part in reconstruction after raid damage provided that manufacturers are willing and able to give them the necessary backing

It is obviously necessary for the authorities to recommend that persons who have no vital reasons for visiting damaged areas should refrain from doing so, in order that the work of clearance and reconstruction shall not be impeded but such instructions should not be interpreted to mean that helpful visits of manufacturers' representatives are prohibited. It is only by actually visiting the areas that the representatives can obtain for their employers an estimate of the immediate need of vital replacements and thus arrive at some idea of the importance of quickly sending supplies. Replacements required for repair work and the reconstruction of damaged factories engaged on important Government work may quite possibly be of more vital importance to the defence of the country than many of the priority orders still on the manufacturer's books.

The representatives can also find much additional information which will assist their employers. Those customers whose premises have been very severely damaged and who have not had the time to arrange temporary accommodation may possibly have placed previous orders with the manufacturers which are now due for delivery. The representatives can arrange for such orders to be suspended or the material transferred to satisfy other desperate and vital demands and thus avoid further confusion and disorganisation of transport arrangements which would arise had the goods been sent to the original addresses. This slight extra effort will do much to assist manufacturers and at the same time will help the national effort.

It is surprising how much the visits of manufacturers' representatives are appreciated by their customers in the damaged areas. Apart from a real and personal appreciation that the manufacturers feel some concern for the welfare of their customers there is, too, a feeling of satisfaction that they realise the difficulty of their customers' position and will do their very utmost to provide them with the material they urgently require. The manufacturers' representatives will receive the fullest co-operation from the wholesalers in those areas, for they can be assured that no time has been lost in gathering information of the approximate quantities of material of vital necessity which will be required to enable, at least, the most important factories and public services to resume.

Immediate repair and reconstruction of vital factories which have been damaged and help in re-organising the essential public services, particularly lighting and heating, would be very considerably delayed were it not possible to take advantage of the stocks of electrical merchandise available in the local warehouses of electrical wholesalers. Of equal importance is the fact that as regular stockists of all the equipment likely to be required it is more than probable that they have orders outstanding with manufacturers and it is far less difficult for a manufacturer to anticipate delivery by a few weeks of an order already included in his manufacturing programme than to handle a new order.

If all the equipment required was ordered direct from manufacturers, many of them situated some considerable distance away, a great deal of time would elapse before all the accessories sufficient to start the job could be collected, apart from the possibility that the manufacturers of each of the items might be unable to give immediate assistance.

The manufacturer and the wholesaler will not be forgotten for this extra service when times return to normal and they will have the satisfaction of knowing that they have each done their own extra but valuable share to alleviate suffering and inconvenience in damaged areas whilst at the same time assisting in the war effort.

The clarion cry of the nation is "Help One Another" and events have proved the excellent results achieved by acting on its principles. Between them, the manufacturers and their wholesale distributors can prove the real value of their distribution scheme which has as its object the placing of stocks of materials in various strategic centres throughout the country—a most necessary requirement in these days—for the benefit of industry in general.

The wholesaler whose warehouse is situated in a comparatively safe area deserves, therefore, equal consideration from manufacturers, for there is no telling when he will be called upon to assist his more unfortunate fellows by sharing amongst them any stocks of electrical equipment not immediately required by the customers in his own area. Petty jealousies and trade rivalries may have their uses in the competitive spirit of normal times but they must not be allowed to exist to-day. If the manufacturers will keep their distributing outlets well served we can be assured that the wholesalers will play their part in redistributing their valuable stocks in the best interests of the nation.

New Cyclotrons

A 184-in. cyclotron, which has been designed under the supervision of Professor E. O. Lawrence to produce 100 million electron volts, is being built for the University of California and will be the largest cyclotron yet made. The equipment will take 2,500 kVA from the 12,000 V three-phase 60-cycle AC mains and rectify it to 25,000 V DC, which will be fed into the oscillator of the cyclotron, operating at 10 million cycles per sec. The cyclotron will weigh 4,900 tons and contain a magnet 56 ft. long, 30 ft. high and 15 ft. 4 in. wide. The atoms are fed into a circular chamber, where they receive successive "kicks," causing them to whirl round in widening circles until they reach a port on the side, over which is placed the element to be bombarded in order to release electronic energy.

The approximate cost of this cyclotron is given as $1,400,000. One of its most important duties will be in investigating the setting up of chain reactions in the isotope of uranium known as U-235, evidence of the possibility of which was established a few months ago at the Pupin Physics Laboratory, Columbia University (where the largest existing cyclotron is installed). So far U-235 is the only element indicating such chain reaction, which would permit automatic conversion of atoms into power of great magnitude, once the chain was started.

A cyclotron is also to be constructed in Moscow this year capable of imparting 50 million electron volts to heavy hydrogen ions. Its estimated cost is 1.5 million roubles. The magnet core will weigh 1,000 tons and the solenoid 18 tons.

ELECTRICITY SUPPLY

Purchase Tax Provisions. Barnoldswick Decision. Shipbuilders' Change-over.

Aberdeen. — NEW SUBSTATION. — Mr. Alexander Gardner, city electrical engineer, in his report to the Town Council on the proposed developments mentioned in our last issue, recalled that on June 9th and August 2nd 1939, the Electricity Commissioners sanctioned the construction and equipment of a permanent substation of 6,000-kW capacity at a total cost of £15,770. With the outbreak of the war it was decided to postpone this work as long as possible, and a steel transformer kiosk for 500 kW capacity was erected on the site. This has since been supplemented by a temporary shed containing further 500 kW of transforming plant, but the loads already registered show that, by another winter, further plant will be required. The increase is due to the natural growth of the load on the AC mains, but, in addition, it will now be necessary to change over existing consumers to relieve the DC mains in the district.

Mr. Gardner accordingly recommended that application be made to the Electricity Commissioners for permission to proceed with the permanent substation already sanctioned by them, but with equipment of only 3,000-kW capacity in the meantime, the total cost (allowing for the increased cost of equipment) being £13,095. This course was agreed to by the Electricity Committee and subsequently by the Town Council.

Barnoldswick.—BULK SUPPLY.—The Electricity Commissioners have conducted an inquiry into the question of augmenting supplies in bulk to Barnoldswick and whether the District Council should continue taking electricity from Nelson Corporation or change over to the Yorkshire Electric Power Company. The Council desired to obtain bulk supplies from the Power Co. whose mains are easily accessible and the necessary application was made. This question has been under consideration for two years and the Commissioners have now decided to permit the change-over.

Barrhead. — HEATING OF COUNCIL CHAMBER.—The Town Council has instructed the Master of Works to carry out additional electric heating in the Council Chamber.

Birkenhead.—PURCHASE TAX ON HIRED APPLIANCES.—The Electricity Committee has considered the effect of the purchase tax upon the hire and hire-purchase schemes, and recommends that in the case of hire purchase the tax on the apparatus shall be payable by the purchaser in one amount at the time the agreement is made and that in the case of simple hire the tax shall be recovered by increased instalments spread over the first two years of the term of the agreement.

LOANS.—The Electricity Committee has obtained sanction to borrow £1,500 for substation equipment and £4,500 for consumers' apparatus.

Blackburn.—ELECTRICITY PROFIT.—The borough treasurer reports that electricity income surpassed last year's high figure with a total of £312,486, and there was a net profit of £9,778. The accumulated surplus stands at £79,215. On the tramways there was a gain of £13,804.

Blackpool. — SHELTER LIGHTING. — The Corporation Emergency Committee recommends a scheme prepared by the borough electrical engineer for lighting shelters.

Burnley. — PURCHASE TAX ON HIRE-PURCHASE GOODS.—The Corporation Electricity Committee has considered the application of the purchase tax to goods sold on hire-purchase and has resolved that when a purchaser so desires, payment of the tax may be made by instalments over any period not exceeding three years.

Caernarvon.—INCREASED CHARGES.—Electricity charges are to be increased by ¼d. per kWh immediately and reviewed at the end of the current financial year.

Cardiff. — IMPROVED RESULTS. — After showing a loss of £7,504 for the year 1938-39, the City Electricity Department (engineer and manager, Mr. Edward Jones) is able to record a net surplus of £31,650 for last year. The total revenue increased from £473,125 to £554,344, while the working expenditure rose from £406,016 to £435,046. Interest and sinking fund contributions, etc., accounted for £87,648, as compared with £74,613. Despite a considerable reduction in consumption for lighting due to the extension of summer time, restrictions due to A.R.P., and transfers to the all-in tariff, the total sales of electricity at 198 million kWh increased by 52 million kWh or 36 per cent. Energy sold for industrial power purposes showed an advance of 53 per cent. The average price obtained per kWh for all purposes was 0.6388d. as compared with 0.7504d. New consumers connected during the year, numbering 1,695, brought the total to 60,838, the assisted wiring scheme being responsible for 305. There was a net increase of 212 cookers fixed, the total on circuit being 11,563.

Cheltenham. — SWITCHGEAR. — The Corporation Electricity Committee has obtained sanction to borrow £1,366 for switchgear, etc.

Chester.—LOAN.—The Town Council is recommended to apply for sanction to borrow £555 for transformer switchgear and underground cables at Tarvin.

Colchester.—YEAR'S WORKING.—For the year ended March 31st last there was a deficit of £7,816 on the year's working of the corporation electricity undertaking. The electrical output was reduced by over two million kWh and the loss of revenue from street lighting alone was nearly £2,000. The increased cost of coal was £5,913 and the cost of bulk supply rose by £3,685.

Eastbourne. — RECOVERY OF HIRE CHARGES.—The Electricity Committee has decided that accounts for compensation charges due under hire-purchase agreements shall be rendered, but that where the amounts cannot be recovered owing to the operation of the Defence (Evacuated Areas) Regulations, 1940, the hirer shall be offered the alternative of extending the minimum period of the agreement.

Fareham. — A SUPPLY FOR WALLINGTON. —The Council is to give a supply of electricity to Wallington, the charges to be £5 per kW, plus 1d. per kWh.

Finchley. — SHELTER HEATING. — The Civil Defence Committee is not in favour of the installation of coal stoves in public shelters and the Council has agreed to submit to the County Council a scheme for electric heating and ventilation at a cost of £2,000 prepared by the Committee.

Gainsborough.—YEAR'S WORKING.—Last year the Urban District Council Electricity Department recorded a total revenue of £34,298, with a gross profit of £7,363. There was a net deficiency of £466. Sales of electricity increased from 6,145,086 to 6,281,385 kWh.

Gosport.—SCHOOL SHELTER HEATING.—The Town Council is to have school shelters heated by electricity.

Harrow.—SHELTER LIGHTING.—The Urban District Council surveyor has been instructed to provide lighting for communal shelters, at an estimated cost of £16,200.

Harwich. — INCREASED SALES. — In his report for the year ended March 31st last, Mr. J. H. Shepherd, the borough electrical engineer states that electricity sold during the year excluding e.h.v. supplies to the L.N.E.Railway, showed an increase of 380,248 kWh or 12 per cent. Approximately two-thirds of this increase was in respect of the first five (pre-war) months, and excluding energy sold for power and street lighting 83 per cent of the total sales were on two-part tariff, the average price obtained per kWh being 1.115d. as against 1.151d. for the previous year. An increase of £710 in revenue was more than offset by increased bulk supply charges (£820). Due to this, together with other increased working costs, the loss of the street lighting load, the extended summer time, the blackout, the threatened restriction of consumption to 75 per cent. of the normal and a stoppage of development a net deficit of £1,433 resulted. The full effect of tariff increases introduced to cover the last quarter will only be felt in the current financial year, but even so, the result of this year's trading is very problematical.

CHARGE FOR INSTALLING HIRED APPARATUS.—In future the following charges are to be made for wiring involved in the installation of hired apparatus: 15s. per cooker, 20s. per 12-gal. rapid water heater including plumbing, 7s. 6d. per 1½-gal. thermal storage water heater.

LOANS.—Application is to be made for sanction to loans to cover anticipated expenditure on unspecified mains and services (£1,000) and hired apparatus (£800) for twelve months.

Hull.—SHELTER HEATING.—The Corporation Emergency Committee has considered a report by the manager of the Electricity Department, with reference to heating communal shelters, who mentioned that whilst arrangements had been agreed to by the Committee whereby householders could provide electric fires in individual domestic shelters, no instructions had been given regarding their use in communal domestic shelters. The Committee had approved the provision of low-temperature electric heating appliances in these shelters (in view of fire risks with the exposed element types). The city engineer asked for instructions when applications were received for permission to install electric fires in communal shelters and the Committee decided that where a householder desired to install any form of low-temperature appliance for electric heating at his own expense it would have no objection provided that the wiring was satisfactory to the Electricity Department and the supply was obtained through the householder's meter.

APPLICATION TO BORROW.—The Corporation Electricity Committee has obtained sanction to borrow £504 for mains and £8,219 for substation equipment.

HEATERS FOR AMBULANCES.—The medical officer of health has reported to the Emergency Committee, having considered the question of the installation of electric heaters in ambulance vehicles, and the manager of the Electricity Department reported that the probable cost of providing such heaters in 133 vehicles, including five mobile units, and inclusive of the cost of wiring the various depots and posts for the purpose, was approximately £560. The scheme was approved.

SUPPLY TAKEN OVER.—The manager of the Electricity Department has reported that he has made arrangements with the South East Yorkshire Light & Power Co., Ltd., to take over the supply afforded by it to the Winestead Mental Colony.

Inverness. — A GOOD YEAR.—Mr. George C. MacLean, engineer and manager of Inverness Corporation Electricity Department, in his annual report, states that, including the partial bulk supply from the Grampian Company, 6,216,553 kWh was generated last year, the highest figure on record, representing an increase of 245,211 kWh. The departments' accounts showed a surplus of £653, although it had been anticipated there would be a deficit of £565, due to reductions in charges. The average cost per kWh sold was 1.37d., compared with 1.21d. in 1938-39, and the average cost per kWh generated was 0.1d. higher than the previous year, due to increased cost of fuel and materials and increased wages.

Maidenhead. — DEARER ELECTRICITY. — Until November 30th there was an increase of 745,000 kWh in the amount of electricity sold during the current financial year as compared with the corresponding period of 1939-40. This advance was accompanied by an undue increase in load, the effect of which, together with that of a further rise in the price of fuel, will seriously increase the average cost per kWh. As a result the Electricity Committee recommends that, as from the meter readings at the end of the March quarter, (1) the "unit" charge under the quarterly two-part tariffs should be increased by 0.125d.; and (2) under the prepayment two-part tariffs, retaining the standard "unit" charge of 1½d., the rebates should be reduced by 1½d. in the shilling in the borough, and by 1d. in the districts outside the borough.

Manchester. — FANS FOR SANATORIUM. — Electric fans at Abergele children's sanatorium costing £415 are to be provided by the Corporation Emergency Committee.

SIREN CONTROL.—The Electricity Committee has approved a scheme for extended use of the Ripplay system of siren control.

The Health Committee is to install tubular electric heating in twelve welfare centres.

Mansfield.—HEATING OF SCHOOL SHELTERS.—The Corporation is to experiment with electric heating to eliminate dampness in school shelters.

Whitehaven. — INCREASE IN CHARGES. — The following increases in the electricity tariff are to be introduced as from January 1st:—Lighting, including the "unit" charge on the two-part tariff, cooking and heating, ½d. per kWh; low-voltage power, 5 per cent. To meet the increased cost of maintenance the hire of heating and cooking apparatus (not including radiators), installed after December 31st, 1940, is also to be increased by 50 per cent.

Middleton.—HIRE & HIRE PURCHASE.—The Town Council has decided that simple hire and hire-purchase facilities for electrical appliances shall be continued in their present forms subject to the following conditions:—Simple hire: That before any appliance is installed the hirer shall be required to pay the purchase tax on the appliance, plus any increase in the cost of the appliance since the outbreak of war. Hire purchase: That the hirer shall be required to make an initial payment of an amount equivalent to the purchase tax on the appliance, plus any increase in the cost of the appliance since the outbreak of war.

It was objected at a meeting of the Council that the decision was tantamount to saying that the ordinary working man could not have appliances, as it was more than he could pay.

Nelson.—WARNINGS VIA CABLES.—The Corporation has decided to install apparatus for transmitting air raid warnings through existing electric cables, and the tender of the Automatic Telephone & Electric Co., Ltd. (£1,038) for the provision of "Rythmatic" injection equipment for twelve signals and remote control has been accepted. Authorities supplied with electricity from Nelson are to be invited to discuss co-operation in the scheme.

Salford.—COOKER LOAN.—The Lighting Committee is seeking sanction to borrow £5,000 for electric cookers.

Scarborough.—LOANS.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £1,589 for mains and services; £738 for substations and equipment; and £496 for meters.

Sleaford.—CHARGES INCREASED.—Notice has been given by the Urban District Council that as from January 1st an increase of 5 per cent. will be made in respect of all charges and tariffs for electricity (including the fixed quarterly charge under the "all-in" domestic tariff) with the exception of prepayment meter lighting.

South Shields.—CHANGE-OVER SCHEME.—John Readhead & Sons, shipbuilders, are to change over the electricity supply at their works from DC to AC at a cost of £10,000. The South Shields Town Council is to contribute £1,750 towards the cost. The Council is to apply to the Electricity Commissioners for sanction to take £2,500 from the reserve fund for mains extensions in connection with the change-over.

MUTUAL EMERGENCY POWER.—The Town Council has made arrangements with the Harton Coal Co., Ltd., whereby either party will obtain DC power from the other in an emergency.

Stalybridge.—CONCESSION FOR DAMAGED PREMISES.—The Stalybridge, Mossley, Hyde and Dukinfield Joint Electricity Board has adopted a suggestion made by the engineer (Mr. J. H. Lumsden) that in the event of damage by enemy action to premises of consumers, rendering them uninhabitable for a period of not less than one week, the payment of fixed charges under the two-part tariff and instalments on hire-purchase of apparatus shall be waived during the period the premises are uninhabitable.

COAL HANDLING EQUIPMENT.—The Board has authorised the engineer to obtain quotations for coal handling plant, and an estimate of the cost of land on which to store considerable additional supplies of coal. The engineer has advised the Central Electricity Board that in consequence of the increase in the maximum demand of the Glossop undertaking it is necessary to increase the capacity of the transformers.

Tonbridge.—YEAR'S WORKING.—The Electricity Department reports a gross profit of £12,484 for 1939-40 and a net profit of £1,897. This is added to £9,350 brought forward, making £11,247 available. From this £1,718 is devoted to capital expenditure out of revenue and £600 to relief of rates, leaving £8,929 in hand. There was a rise of over half a million kWh in sales entirely due to higher domestic consumption.

Overseas

Canada. — THE ST. LAWRENCE SCHEME. — The diplomatic experts from Canada and the United States who have been negotiating about the St. Lawrence waterway project, having received the report of the joint committee appointed to make an engineering study of the International Rapids section of the river, have completed work on the draft agreement, which will be submitted to both Governments. *The Times* understands that the draft covers all the navigation and power aspects of the scheme, from Montreal to the head of the Great Lakes.

OVERHEAD 220,000-V. POWER LINE CONSTRUCTION.—Approximately 210 miles of towers and 85 miles of conductor have been erected in connection with the new 220,000-volt transmission line being constructed from Beaudet, on the Ontario-Quebec boundary south of the Ottawa River, and Toronto. The line was started last July and is expected to be completed by the beginning of next April. A 46-mile extension from Toronto Burlington is to be started in February, and over three-quarters of the necessary construction roads to Barret Chute on the Madawaska river, site of a proposed new 54,000 H.P. plant, have been completed.

India.—PROPOSED MUNICIPAL PLANT FOR KARACHI.—At a meeting of the Karachi Municipal Council in August it was decided that the Public Works Committee should prepare a complete scheme for a municipal generating plant. At present electricity is provided by the Karachi Electric Supply Corporation, Ltd. It was mentioned during the Council's discussion that the present licence expired in 1941 and under the terms of the agreement it had to give eighteen months' notice of termination.

TRANSPORT

Darlington. — DEFECTIVE OVERHEAD LINES.—At a meeting of the Town Council reference was made to the delays experienced in trolley bus services owing to breakdowns in the overhead equipment. Councillor Dodd asked what reserve fund the undertaking had, suggesting that it might be devoted to renewing the overhead equipment. Alderman Hinks replying said the reserve fund was about £8,000. The war had stopped the scheme for renewing the overhead lines, and it was impossible to obtain the equipment now. What they were getting for ordinary repairs was only moderate material which could not stand the strain and this caused breakdowns.

Glasgow. — ILLUMINATED HELMETS FOR POLICE.—Illuminated helmets with lighted signs reading "police" on one side and "stop" on the other are to be worn by traffic policemen to assist motorists at busy crossings during the black-out. They will be operated from accumulators carried on the belts.

RADIO AND TELEPHONY

Bournemouth.—WIRELESS FOR POLICE.—The Lighting Committee has prepared a scheme for wireless communication for the police and fire brigade at a cost of £1,000.

Dudley.—POLICE WIRELESS.—The Watch Committee is to make provision for a police wireless system in the new police buildings.

Enfield. — WIRELESS FOR THE FIRE BRIGADE.—A wireless service for the fire brigade costing £564 is to be provided.

France.—ALL WIRELESS STATE-CONTROLLED.—All private radio-transmitting stations in non-occupied France are to be requisitioned, by order of M. Baudouin, Secretary to the Prime Minister's Office, says a Vichy dispatch *via* Geneva to the German official news agency. This step has been taken, it is explained, now that the information and propaganda services have been merged with the Prime Minister's Office. The stations concerned are those of Lyons, Marseilles, Toulouse and Nice, which started independent broadcasts after the armistice. They will in future only give the programmes of the State radio station, Radio Diffusion Française. The State control of these stations, adds the report, represents the first step in a large scale reorganisation of the whole wireless system.—*Reuter* (Berlin).

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

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903. "Intercommunication telephony by carrier system." J. H. C. von D. Hardinge and C. G. Alexander. March 11th, 1939. (530679.)

7230. "Secret transmission of television and like signals." Scophony, Ltd., and A. H. Rosenthal. March 6th, 1939. (Cognate application, 8522/39.) (530776.)

7233. "Television and like apparatus." A. H. Blue and R. D. Wood. March 6th, 1939. (530777.)

8181. "Inductive train signalling and/or control systems." Vereinigte Eisenbahn-Signalwerke Ges. March 14th, 1938. (530681.)

8552. "Electrical oscillating systems." Board of Trustees of Leland Stanford Junior University. April 14th, 1938. (530785.)

8667. "Apparatus for magnetising permanent magnets." Raleigh Cycle Co., Ltd., and G. W. Rawlings. March 18th, 1939. (530779.)

9429. "Production of high-velocity ions." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. March 26th, 1938. (530726.)

12264. "Driving arrangement for electrically driven accumulator vehicles." Allmänna Svenska Elektriska Aktiebolaget. April 27th, 1938. (530826.)

12287. "Electrical condensers and electric circuit connections therefor." C. H. Last, H. Hesketh and Metropolitan-Vickers Electrical Co., Ltd. April 24th, 1939. (530684.)

13920. "Thermionic valve circuit arrangements." E. L. C. White. May 10th, 1939. (530620.)

16751. "Electric discharge lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. June 7th, 1939. (Cognate application, 16753/39.) (530828.)

16752. "Electric discharge lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. June 7th, 1939. (530829.)

16850. "Band-pass filters." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust, J. D. Brailsford and E. F. Goodenough. June 8th, 1939. (530693.)

17149. "Bollards and the like applicable for road traffic signs." P. S. Taylor. June 12th, 1939. (530788.)

17258. "Devices for lighting operating rooms." Anciens Etablissements Barbier, Benard & Turenne. July 29th, 1938. (Cognate application, 17259/39.) (530789.)

17287. "Super-imposed telegraph and telephone systems." Standard Telephones & Cables, Ltd. (L. A. G. A. Braem, and J. Sobola.) June 13th, 1939. (530621.)

17350. "Electric tumbler switches." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. June 14th, 1939. (530622.)

17386. "Suction cleaners." Hoover, Ltd. June 27th, 1938. (530623.)

17387. "Electrical measuring instruments and relays." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. June 14th, 1939. (530698.)

17416. "Electric lifts and the like." J. & E. Hall, Ltd., and S. T. Elvy. June 14th, 1939. (530831.)

17433. "Motor control systems." Westinghouse Brake & Signal Co., Ltd. November 25th, 1938. (530626.)

17493. "Electrical remote control or signalling systems." Sangamo Weston, Ltd., G. Gilliver, G. F. Tagg and G. F. Shotter. June 15th, 1939. (Cognate application 26658/39.) (530627.)

17518. "Screening arrangements for thermionic valves." British Thomson-Houston Co., Ltd. June 16th, 1938. (530701.)

17528. "Speed control systems for direct-current electric motors." Westinghouse Brake & Signal Co., Ltd., and S. A. Stevens. June 15th, 1939. (530628.)

17654. "Spacing members for air apace cables." Standard Telephones & Cables, Ltd., J. F. Morley and S. G. Foord. June 16th, 1939. (530703.)

17713. "Electrical communication systems employing wave repeaters." Standard Telephones & Cables, Ltd., and F. G. Filby. June 17th, 1939. (530704.)

17855. "Electric motor control for radio receivers." Marconi's Wireless Telegraph Co., Ltd. June 17th, 1938. (530793.)

17856. "Preselection tuning systems for radio receivers." Marconi's Wireless Telegraph Co., Ltd. June 18th, 1938. (530835.)

17860. "Signal amplitude-limiting circuit." Philco Radio & Television Corporation. July 16th, 1938. (530794.)

17958. "X-ray apparatus incorporating protective switches." Standard Telephones & Cables, Ltd., W. T. Gibson & R. A. L. Cole. June 20th, 1939. (530840.)

17961. "Adjustable inductances and the like." Kolster-Brandes, Ltd., and M. D. Mason. June 20th, 1939. (530841.)

17964. "Two-way electrical wave transmission systems." Standard Telephones & Cables, Ltd., and R. Walsh. June 20th, 1939. (530842.)

17978. "Couplings for electrical apparatus." A. Reyrolle & Co., Ltd., F. Coates and J. Mirrey. June 20th, 1939. (530843.)

18016. "Dish washing machines." Bolinders Fabriks Aktiebolag. June 29th, 1938. (530848.)

18023. "Sirens." K. H. Lumino-Technical Co., Ltd., and H. Komor. June 20th, 1939. (530851.)

18109. "Mercury boilers." British Thomson-Houston Co., Ltd. June 21st, 1939. (Addition to 464388.) (530852.)

18444. "Fuse switches." Dorman & Smith, Ltd., and T. Smalley. June 24th, 1939. (530854.)

18679. "Electric welding systems." D. T. Smout. June 27th, 1939. (530857.)

18707. "Time control mechanisms for the rapid heating of electric range units or the like." Proctor & Schwartz, Inc. August 28th, 1938. (530710.)

18781. "Electric control systems for direct-current motors." Westinghouse Electric International Co. June 28th, 1938. (530657.)

18881. "Periodical absorption refrigerating plants." S. J. Steensen. June 28th, 1939. (530659.)

18892. "Multi-way electric switches." Vent-Axia, Ltd., and A. L. Collins. June 28th, 1939. (530660.)

18975. "Means for commutating static current convertors." Allmänna Svenska Elektriska Aktiebolaget. July 2nd, 1938. (530732.)

18977. "Semi-automatic machines for heating by electric induction." P. Viry. August 1st, 1938. (530734.)

18992. "Display devices." C. E. Every (Biolite, Inc.). June 29th, 1939. (530738.)

19011. "Means for controlling the speed of power-driven knitting machines." E. L. N. Towle and Metropolitan-Vickers Electrical Co., Ltd. June 29th, 1939. (530740.)

19014. "Heat treatment of metals." Electrical Resistance Furnace Co., Ltd., and W. J. Millar. June 29th, 1939. (530741.)

19118. "Circuit arrangements for combined telephone and telegraph transmission systems." Standard Telephones & Cables, Ltd. (L. A. G. A. Braem and J. Sobola.). June 30th, 1939. (530669.)

19202. "Electric remote control apparatus." Elliott Bros. (London), Ltd., and C. F. Pizzey. July 1st, 1939. (530745.)

19234. "Galvanic dry cells." E. Marhenkel. July 6th, 1938. (530859.)

19246. "Electric mining lamps." Friemann & Wolf Ges. July 1st, 1938. (530750.)

19302. "Sheet metal cooker structures." Junkers & Co., Ges. July 4th, 1938. (530763.)

19303. "Electromagnetic relays." Igranic Electric Co., Ltd., J. R. Taylor, and S. R. Wright. July 3rd, 1939. (530764.)

19304. "Electric incandescent lamps." S. Missol and L. Feld. July 3rd, 1939. (530765.)

19313. "Elastic fluid power plants." British Thomson-Houston Co., Ltd. July 1st, 1938. (530707.)

19333. "Sealing of electrical conductors into envelopes of quartz or the like." Scophony, Ltd., and H. P. Barasch. July 3rd, 1939. (Addition to 488993.) (530770.)

19344. "Machines for making edible ice." W. Dummler. July 2nd, 1938. (Cognate application, 19345/39.) (530773.)

19367. "Electric meters of the induction type." G. Wall, G. McCallum and Metropolitan-Vickers Electrical Co., Ltd. July 3rd, 1939. (530800.)

19376. "Electric transformers." Arc Manufacturing Co., Ltd. July 2nd, 1938. (530807.)

20275. "Electrically heated pitot static tube." P. Kollsman. August 2nd, 1938. (530722.)

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11654. "Methods and apparatus for transmitting or receiving radio signals." Board of Trustees of Leland Stanford Junior University. April 14th, 1938. (Divided out of 530785.) (530869.)

11655. "Methods and apparatus for detecting a high-frequency signal." Board of Trustees of Leland Stanford Junior University. April 14th, 1938. (Divided out of 530785.) (530870.)

11656. "Devices for stabilising a high-frequency regenerative amplifier." Board of Trustees of Leland Stanford Junior University. April 14th, 1938. (Divided out of 530785.) (530871.)

Rumanian Telephones Nationalised

THE Rumanian Telephone Company, controlled by the International Telephone and Telegraph Corporation of New York, has been taken over by the Rumanian Government, according to a Bucharest message to the official German News Agency, quoted by Reuter.

The American concern had, under a Government concession in 1930, acquired the exclusive rights of exploitation of Rumanian telephone services, except those already State-owned and private and railway telephone lines. A few days ago, the German News Agency adds, the United States Treasury granted a licence for the payment of $13,800,000 (about £3,450,000) from blocked Rumanian credits for the liquidation of the New York corporation's interests in Rumania.—*The Times.*

FINANCIAL SECTION

New Companies. Capital Returns. Debenture Charges. Reports and Dividends. Bankruptcies and Liquidations. Stocks and Shares

Reports and Dividends

Further Dollar Securities Called in. — The Treasury has made another Order for the transfer of American securities to the Treasury. The list includes the stocks of the following concerns:—Alabama Power ($7 preferred shares), American Power & Light ($6 preferred shares), American Telephone & Telegraph ($100 shares and three classes of debentures), Carolina Power & Light ($7 preferred shares), Central Power & Light (6 per cent. preferred shares), Columbia Gas & Electric (5 per cent. gold debentures), Consolidated Edison Co. of New York ($5 preferred shares and two classes of debentures), Florida Power & Light ($7 preferred shares), General Cable Corporation (7 per cent. preferred shares), Northern Indiana Public Service (6 per cent. preferred shares), Ohio Edison Co. ($6 preferred shares), Peninsular Telephone (common shares), Pennsylvania Water & Power (common shares), Public Service Corporation of New Jersey ($5 preferred shares), Superheater Co. (no-par-value shares).

The Rheostatic Co., Ltd., is paying a first and final dividend of 10 per cent. (against 16 per cent.). The profit for the year was £8,017, as compared with £19,015 in the preceding year.

The Farnham Gas & Electricity Co., has created £70,000 4½ per cent. debenture stock redeemable June 30th, 1955 at 100 or three years earlier at the option of the company. The Treasury has consented to the issue. The directors have placed the stock through Snell & Swaffield, Sidney J. Lovell & Co., of the Stock Exchange at 99 per cent. net for payment in full on January 15th, 1941. Interest will be payable on June 30th and December 31st, the first payment being for 5½ months and the stock will rank *pari passu* with existing debenture stock.

Thomas De La Rue & Co., Ltd., are not paying an interim dividend on the ordinary shares. For the year ended March 31st last the company distributed 21 per cent., consisting of 6 per cent. interim, 9 per cent. final, and 6 per cent. bonus.

R. B. Pullin & Co., Ltd., have announced a final dividend of 15 per cent. (against 20 per cent.), making 20 per cent. less tax on the ordinary shares (against 25 per cent.).

The Shawinigan Water & Power Co. reports a gross revenue of $12,150,710 for the nine months ended September 30th, as compared with $10,918,937 for the corresponding period of 1939. A net surplus of $1,623,783 compares with $1,677,358.

New Company Registered

J. A. Potter, Ltd.—Private company. Registered in Belfast, December 26th. Capital £2,000. Objects: To carry on the business of motor and electrical engineers. First director: J. A. Potter, 106, Cromwell Road, Belfast.

Companies' Returns

Statements of Capital

Concordia Electric Wire Co., Ltd.—Capital £100,000 in 100,000 shares of £1 each. Return dated August 23rd, 1940. 57,319 shares taken up. £57,319 paid. Mortgages and charges: Nil.

Aron Electricity Meter, Ltd.—Capital £350,000 in 350,000 shares of £1 each. Return dated September 9th, 1940. 151,936 shares taken up. £104,660 15s. paid, being £1 7s. 6d. (including premium) on each of 75,773 shares and £2 8s. 6d. (including premium) on each of 195 shares. £75,968 considered as paid. Mortgages and charges: Nil.

Rawlings Bros., Ltd.—Capital £100,000 in 70,000 ordinary and 30,000 preference shares of £1 each. Return dated September 11th, 1940. 61,401 ordinary and 21,903 preference shares taken up. £83,304 paid. Mortgages and charges: Nil.

Costa Rica Electric Light & Traction Co., Ltd.—Capital £130,000 in 130,000 shares of £1 each. Return dated September 13th, 1940. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges: £219,600.

Increase of Capital

Standard Telephones & Cables, Ltd.—The nominal capital has been increased by the addition of £500,000, in £1 ordinary shares, beyond the registered capital of £2,000,000.

Mortgages and Charges

Walters & Co. (Parkstone), Ltd.—Mortgage on 14 and 16, Bournemouth Road, and motor repair and paint shops off Church Road, Parkstone, Dorset, dated December 16th, 1940, to secure all moneys due or to become due from the company to National Provincial Bank, Ltd.

Woodstock Power Syndicate, Ltd.—Satisfaction to the extent of £2,300 on June 29th, 1940, of debentures dated December 13th, 1926, and registered December 29th, 1926. (Notice filed December 27th, 1940.)

Graham Farish, Ltd.—Satisfaction in full on July 1st, 1939, of debentures registered April 14th, 1938, securing £1,000. (Notice filed December 23rd, 1940.)

Receiver Appointed

Metcalf Electrics, Ltd.—J. P. Wardale, Hepper House, East Parade, Leeds, was appointed receiver on December 18th, 1940, under powers contained in instrument dated April 5th, 1940.

Liquidations

British Porcelain Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. H. Parrott, 4, Southampton Row, London, W.C.1. Particulars of claims to the liquidator by January 31st.

Sparkbrook Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. A. W. Watson, 5, Waterloo Street, Birmingham.

Charles H. Barratt & Co., Ltd.—Meeting February 5th at Houldsworth Hall, Deansgate, Manchester, to receive an account of the winding-up by the liquidator, Mr. P. Nelson.

Ilkley Wireless Service Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. H. Turnbull, 32, Cookridge Street, Leeds.

Bankruptcies

Improved Radio & Electrical Co., Oxford House, Falcon Sq., E.C.—The first meeting of creditors was held recently at the London Bankruptcy Court, the receiving order having been made upon the petition of a creditor. The debtor, Maurice Hyman, stated that he had failed on two previous occasions, from which proceedings he had been discharged. He began the present business in 1934 and attributed his failure to insufficiency of assets to cover overhead expenses and drawings and to lack of business owing to industrial unrest. The liabilities are estimated at £2,000, against assets valued at £60. The case was left in the hands of the Official Receiver.

A. T. Burden, electrical engineer, Meth-Lac Works, Upper Devizes Road, Salisbury. —Order made December 5th, 1940, granting discharge.

A. J. Davis, wireless dealer and electrician, 15, Bridge Street, Exeter.—First and final dividend of 2s. 4¼d. in the £, payable January 28th at Exeter Bank Chambers, Broadgate, Exeter.

I.E.E. ARRANGEMENTS

As already announced, the Council of the I.E.E. has decided that under the prevailing conditions it would be inadvisable to hold meetings of the Institution in London during the second half of the session. A list of papers that would have in normal circumstances have been included in the programme of meetings is given below and advance copies of these papers can be obtained on application to the secretary by members who contemplate the submission of written contributions for publication in the *Journal* as a discussion with the author's reply.

The approximate dates on which the advance copies will be available are shown in parentheses. Separate application should be made for each paper, and it is hoped that in the interests of economy members will apply for only those papers to the discussion of which they are likely to contribute:—"Electricity in Paper Mills," by Messrs. W. J. Mason and S. A. G. Emms (February 1st); "The Design of Television Receiving Apparatus," by Mr. D. J. Edwards (February 5th); "The Electricity Supply (Meters) Act, 1936—Its Legal and Technical Implications," by Mr. A. Evans (February 7th); "Outdoor Bushings for Transformers and Oil Circuit Breakers," by Mr. W. A. Cook (February 12th); "The Future of Domestic Electrification," by Mr. P. Schiller (February 20th); "The Fluctuation of Space-Charge-Limited Currents in Diodes," by Mr. F. C. Williams (March 5th); "The Mechanism of the Lightning Discharge and its Effect on Transmission Lines" (E.R.A. Report S/T18) by Messrs. C. E. R. Bruce and R. H. Golde (March 20th); "Subsidence Transience in Circuits Containing a Non-linear Resistance with reference to the Problem of Spark-Quenching," by Messrs. A. Fairweather and J. Ingham (April 24th).

A formal ordinary meeting of the Institution will be held on January 30th at 12.30 p.m. for the purpose of carrying out a ballot in respect of candidates whose names were suspended at the ordinary meeting held on January 2nd. It is proposed to arrange for the Kelvin Lecture by Dr. S. Chapman to be delivered on May 8th at 3 p.m. immediately following the annual general meeting, which is to be held on that day at 2.30 p.m. Dr. Chapman's subject will be "Electrical Works by Helios, or the Sun and the Ionosphere."

STOCKS AND SHARES

TUESDAY EVENING.

So far from there being any signs of contraction of public interest in stocks and shares as a result of the new war issues, the reverse is the case. Stock Exchange markets find a gradual expansion of business and of inquiry, and this in face of a temporary dislocation of telephone facilities. Thanks to the energy and the ingenuity of the telephone engineers, a good part of the service was restored in a short time.

Most of the markets exhibit that robust firmness which indicates a flow of steady demand. Home Railway stocks have been going ahead in brisk fashion. Some of the industrial sections are better supplied with would-be buyers than with the stocks and shares which buyers want. Freedom of dealing is necessarily circumscribed by war conditions, but, allowing for this, the volume of daily business is showing a disposition to broaden out in various directions.

Southern Railway Preferred

An outstanding feature of the moment is the strength shown by Home Railway stocks. This is noticeable particularly in the junior issues, amongst which Southern preferred stands out as being one of the most popular. It was pointed out here last week that at its then price, the stock paid 11 per cent. on the money, assuming, as it is reasonable to do, that the full 5 per cent. dividend for the year will be duly paid. Attention having been drawn to the higher return, the price has risen 6 points within the week, standing now at 51½, at which the return comes to £9 14s. per cent., without taking into account the half-year's dividend accrued in the price. The stock has received its full 5 per cent. for five years past. Were it not for the uncertainty felt as to the probable modification of the agreement between the railways and the Government, the price would be standing at any rate ten points higher than it does now.

Amongst the matters which will be raised by the Government is the question of increasing still further the charges upon passenger and freight traffic. The date of the conference to be called between the Government and the Railways has not yet been announced. So darkly has the Home Railway market lain under a cloud for some time past, that even speculation is hesitant as to the permanence of the recent rise in prices.

The price of London Passenger Transport "C" stock is unchanged at 33, at which price the return on the money comes to no more than £4 11s. per cent. The Board's prior-charge stocks hold their previous prices. They are not likely to be affected in any way by the result of any alteration of terms between the Government and the Railways. These prior-charge stocks are influenced almost entirely by the tendency of War Loan and other gilt-edged securities.

Confidence cum Insurance

Pressing demand for ordinary shares in the equipment and manufacturing group serves to keep prices on the rise. In most of the cases where the market quotations have not moved, the fact remains that buyers are prepared to give these, or rather higher figures. In the Stock Exchange market, the theory is advanced that this constant pressure to buy shares in companies whose property is situated, it may be, in a danger zone, can be ascribed to the recently announced scheme of Government insurance. Inquiry for such shares had been noticeable for some time before the insurance plan was formulated, but since then the demand has perceptibly increased.

It is better, says a frequent argument, to pay insurance premiums with the knowledge that compensation is assured after the war if property is destroyed, than it is for a company to run the risk of such damage without having any cover in the shape of compensatory payment at the end of hostilities. Reassurance on this point has put a keener edge on the appetite of investment for the ordinary shares of companies in the equipment and manufacturing group.

Rising Prices

British Insulated ordinary at 4¼, and Callender's, at 3¼, are both half-a-crown up. Henley's are up to 20s. Enfield Cables have gained 1/16 at 48s. 9d. Although the nominal price of Ericssons remains at 32s. 6d., there are buyers ready to pay more. Murex at £4 are 2s. 6d. higher, the dividend of 20 per cent. being handsomely exceeded by the company's earnings. General Electrics maintain their rise at 77s.: the 6½ per. cent. preference are 1/16 up at 31s. 3d. Siemens are 1/16 better at 18s. 9d. A rise of 2s. 6d. lifted Walsall Conduits 4s. shares to 26s. 3d., at which the yield is still the good rate of 8⅜ per cent. on the money. Cable and Wireless 5½ per cent. preference put on three points, advancing to 96½. Anglo-American Telegraph 6 per cent. preferred is up to its par price of 100. Marconi Marines have again reached 20s. The electricity supply changes continue in the upward direction, London Associated, exceptionally, being a dull spot at 13s. 9d. Lancashire Electric, Yorkshire Electric, Bournemouth & Poole, and Electric Finance are all 1/16 harder. British Electric Traction 8 per cent., preferred rallied fifteen points, to 160, upon the absorption of a small amount of stock that had been on offer.

The electricity supply companies start declaring their dividends in March for the final half of the previous year. As though in preparation for this, investment, particularly that which emanates from the North, is trying hard to buy shares in the principal companies, the impression prevailing that dividends will be at the same rates as those of last year in the cases of the provincial companies. That the London undertakings may cut their final dividends, as compared with those of a year ago, is generally assumed: prices have already discounted a possible reduction.

Preference Shares

In the inquiries that are now being made for preference shares the dividend service of which is well covered by earnings, the electricity supply market is naturally one of the principal departments to which demand is directed. Jobbers' books have been nearly all cleared of such investments, but 2,500 Llanelly & District Electric Supply 6 per cent. cumulative preference are available at 25s. 3d., dividends due on 1st February and August. At this price the yield is £4 15s. per cent. on the money. In last year's accounts, after allowing for income tax, there was £79,300 as cover for the £22,500 needed for the annual service of this preference dividend, being rather more than 3½ times. South Metropolitan Electric 4 per cent. third preference shares are offered, as to a thousand or so, at 19s. 9d., March and September dividends. The dividend service in this case was covered by the last-published earnings more than ten times. The yield is no more than £4 1s. per cent. Investment nowadays is taking well-secured investments to pay what seems to be a modest rate of interest, and this accounts for the comparatively high figure at which such preference shares stand.

Neglected Dollar Stocks

The extra freedom which the Treasury now allows to dealing in a number of American dollar stocks and shares has made little difference to business in the London Stock Exchange. It had been thought that relaxation of the previous ban would revive interest in such dollar shares as American Telephone & Telegraph, Brazilian Tractions and other American and Canadian issues. So far, however, this expectation has failed to materialise.

The definite policy of aid from the United States of America, as adopted by President Roosevelt, has had singularly little effect upon Stock Exchange prices. In Wall Street, the stock-broker's activities have still to find scope for expansion to what may be called their normal extent. American prices, it will be noticed from our lists, show little change from week to week.

"N.T.P."

The would-be buyers of electricity supply shares frequently find, nowadays, that their orders can be executed if they, the buyers, will consent to deal "Not to Press." This means that the jobbers in the Stock Exchange market, not being possessed of the shares, or knowing where to go for them, are willing to sell only on condition that the purchaser will allow extra time for delivery of the stock. The jobbers hope that sellers will come along in the ordinary course of business and supply them with the shares which they require in order to satisfy not only to-day's buyers, but, in many cases, those to whom the shares have been due from the end of last year.

Some people refuse to buy shares under this proviso. The Stock Exchange Committee might decline officially to recognise a bargain done on "Not to Press" terms. But as it is the only way by which certain shares in short supply, can be purchased, the anxious buyer consents to this method of dealing, knowing that he is certain to get delivery of the shares at some future time. He is also aware, that meanwhile, though he may not be possessed of the transfer, he is entitled to whatever dividends and other privileges may attach to the shares that he has bought.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Jan. 13	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	63/6	36/6	15	15	45/–	+⅛	—
British Power and Light	30/-	20/–	7	7	26/–	..	5 7 8
City of London	28/–	20/–	7½	7½	21/3	..	—
Clyde Valley	38/6	24/–	8	8	33/9	..	4 14 10
County of London	43/3	21/–	10½	10½	32/6	..	6 9 4
Edmundson's:							
7% Pref.	32/-	24/3	7	7	28/3	..	4 19 1
Ord.	27/6	18/6	9	6	23/6	..	5 2 2
Elec. Dis. Yorkshire	40/3	32/–	9	9	35/–	..	5 2 9
Elec. Fin. and Securities	42/–	34/6	12½	12½	40/–	+⅛	6 5 0
Elec. Supply Corporation	48/–	39/–	12	11½	37/–	..	6 4 4
Isle of Thanet	16/–	5/6	4	4	6/–	..	—
Lancs Light and Power	33/–	21/6	7½	7½	28/9	+⅛	5 4 4
Llanelly Elec.	21/–	17/–	5½	5½	18/–	..	6 2 5
Lond. Assoc. Electric	21/–	12/6	7	5½	13/9	−⅛	—
London Electric	35/–	19/-	8	7	20/–	..	7 0 0
London Power Deb. Red.	105½	100	5	5	103½	..	4 16 6
Metropolitan	41/6	22/6	12	10	32/6	..	6 3 0
Midland Counties	39/–	23/3	8	8	32/6	..	4 18 6
Mid. Elec. Power	40/–	29/6	9	9	33/9	..	5 6 8
Newcastle Elec.	29/9	22/6	7	7	22/6	..	6 7 3
North Eastern Elec.:							
Ordinary	31/6	16/6	7	7	25/9	+9d.	5 8 9
7% Pref.	32/6	25/6	7	7	28/9	..	4 17 5
Northampton	44/–	38/–	10	10	40/–	..	5 0 0
Notting Hill 6% Pref. (£10)	10½	9	6	6	9	..	—
Northmet Power:							
Ordinary	42/3	22/6	10	10	32/6	+⅛	—
6% Pref.	29/–	23/–	6	6	27/–	..	4 9 0
Richmond Elec.	24/6	18/–	7	6	18/9	..	—
Scottish Power	38/–	24/–	8	8	33/3	..	4 16 3
Southern Areas	21/3	12/9	5	5	14/6	..	6 18 0
South London	23/3	20/–	7	7	20/–	..	7 0 0
West Devon	20/–	17/6	5	5	20/–	..	5 0 0
West Glos.	22/–	15/–	2½	4½	16/3	..	5 10 10
Yorkshire Elec.	40/–	23/6	8	8	34/6	+9d.	4 12 10
Overseas Electricity Companies							
Atlas Elec.	4/–	1/3	Nil	Nil	1/9	..	—
Calcutta Elec.	37/–	22/6	10*	8*	34/–	+1/–	4 15 7
Cawnpore Elec.	30/–	24/–	10	10	26/3	..	7 12 4
East African Power	25/6	19/6	7	7	22/–	+⅛	6 7 3
Jerusalem Elec.	24/–	15/–	7	7	20/–	..	7 0 0
Kalgoorlie (10/–)	12/6	9/6	7½	7½	11/6	..	6 10 5
Madras	26/9	21/6	8*	6*	25/–	..	—
Montreal Power	35½	30	1½	1½	32	..	—
Palestine Elec. "A"	25/–	10/–	5*	Nil	20/–	..	—
Perak Hydro-electric	20/3	13/–	2½	6	16/3	..	7 7 8
Shawinigan Power	27½	19	83cts.	90cts.	19	..	—
Tokyo Elec. 6%	69	30	6	6	37	..	16 4 4
Victoria Falls Power	75/9	56/6	15	15	70/-	..	4 5 9
Whitehall Investments Pref.	17/9	8/–	7½	7½	13/–	+6d.	11 11 0
Public Boards							
Central Electricity:							
1950–70	110½	104	5	5	109	..	4 11 9
1955–75	112½	106	5	5	110	..	4 11 0
1951–73	107½	102	4½	4½	105	..	4 5 9
1963–93	96½	90	3½	3½	94	..	3 14 6
London Elec. Trans. Ltd.	92	87½	2½	2½	93	..	2 15 9
London & Home Counties 1955–75	113½	105	4½	4½	105½	..	4 5 4
Lond. Passenger Transport:							
A	116	104	4½	4½	110½	+1	4 1 5
B	116	102½	5	5	104	..	4 15 8
C	65¼	25	1½	1½	33	..	4 11 0
West Midland Joint Elec. 1948–68	106½	103	5	5	105½	..	4 14 9
Telegraph and Telephone							
American Tel. & Tel.	230	176	9	9	200	..	4 10 0
Anglo-Am. Tel.:							
Pref.	107	85	6	6	100	..	6 0 0
Def.	23½	18	1½	1½	23½	..	6 7 8
Anglo-Portuguese	22/6	10/–	8	8	15/–	..	10 13 4
Cable & Wireless:							
5½% Pref.	99½	66	4½	5½	96½	+3	5 14 0
Ord.	65	27	4	4	58½	+1	6 16 9
Income	99½	93	..	..	99½	+1	4 0 5
Canadian Marconi $1	6/–	4/–	Nil	4cts.	4/–	..	—
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½*	6*	26/3	..	4 11 5
Pref.	27/9	22/6	6	6	25/–	..	4 16 0
Great Northern Tel. (£10)	20	11	20	20	12½	..	—
Inter. Tel. & Tel.	5½	2½	Nil	Nil	3	..	—
Marconi-Marine	30/–	18/3	10	7½	20/–	..	7 10 0
Oriental Telephone Ord.	2½	45/–	12*	11½*	2½	..	4 16 10
Telephone Props.	15/–	11/–	6	6	11/3	..	10 13 4
Telephone Rentals (5/–)	9/6	5/3	10	10	7/3	..	6 18 0

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Jan. 13	Rise or Fall	Yield £ s. d.
Traction and Transport							
Anglo. Arg. Trams:							
First Pref. (£5)	4/3	1/–	Nil	Nil	2/–	..	—
4% Inc.	11½	2	Nil	Nil	9	..	—
British Electric Traction:							
Def. Ord.	830	400	5	45	750	..	6 4 4
Pref. Ord.	169	130	8	8	160	+15	5 0 0
Bristol Trams	48/6	32/6	10	8*	37/6	..	—
Brazil Traction	12½	5½	$1	50c.	7¾	..	—
Calcutta Trams	24/–	16/3	8	5½	19/–	..	5 15 4
Cape Elec. Trams	18/6	16/–	5	5	17/–	..	5 17 8
Lancs Transport	35/–	27/6	10	10	35/–	..	5 14 3
Mexican Light:							
1st Bonds	36	25	5	5	35	..	—
Rio 5% Bonds	95	74	5	5	85	..	5 17 8
Southern Rly.:							
5% Prefd.	79	35	5	5	51½	+6	9 14 2
5% Pref.	104½	59	5	5	84½	+1	5 18 4
T. Tilling	45/9	29/–	10	10	41/3	+1/9	4 17 0
Tilling & B.A.	47/6	41/9	9*	8*	44/6	..	—
West Riding	35/–	25/–	10	10	34/6	..	5 16 0
Equipment and Manufacturing							
Aron Electricity Ord.	17/6	10/–	15	Nil	16/–	..	—
Assoc. Elec.:							
Ord.	43/3	26/6	10	10	40/–	..	5 0 0
Pref.	36/6	32/3	8	8	35/–	..	4 11 5
Automatic Telephone & El.	47/3	32/–	12½	12½	40/–	..	6 5 0
Babcock & Wilcox	50/–	28/6	10	11	40/–	+6d	5 10 0
British Aluminium Ord.	56/–	29/–	12½	12½	41/3	..	—
British Insulated Ord.	92/6	67/–	20	20	85/–	+½	4 14 0
British Thermostat (5/–)	14/9	6/6	18½	18½	11/3	..	8 4 6
British Vacuum Cleaner (5/-)	12/–	4/9	40	12½	6/3	..	10 0 0
Brush Ord.	4/6	1/9	Nil	Nil	3/9	..	—
Callender's	69/–	46/–	15	15	65/–	+½	4 12 4
Chloride Elec. Storage	72/6	55/–	15	15	62/6	+½	4 16 0
Consolidated Signal	72/6	59/–	36½	17	60/–	..	5 13 4
Crabtree (10/–)	24/9	17/6	17½	17½	22/6	..	7 15 7
Crompton Parkinson:							
Ord. (5/–)	20/–	12/–	30	20	17/6	..	5 14 3
E. K. Cole (5/–)	5/–	2/6	10	Nil	4/6	..	—
Elec. & Musical Industries (10/–)	10/3	4/3	5	Nil	7/9	..	—
Electric Construction	36/3	27/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord.	56/–	40/6	25	16½	48/9	+⅛	6 13 2
Electrical Switchgear (10/-)	22/6	20/–	16	10	20/–	..	5 0 0
English Electric	33/9	16/6	10	10	28/9	..	6 13 4
Ensign Lamps (5/–)	15/3	12/6	25	25	15/–	..	8 6 8
Ericsson Tel. (5/–)	39/3	23/–	25*	25*	32/6	..	—
Ever Ready	28/3	16/6	30	40	25/6	..	7 16 10
Falk Stadelmann	18/3	12/6	6	7	14/6	..	9 13 2
Ferranti Pref.	25/–	22/–	7	7	23/9	..	5 18 0
G.E.C.:							
Pref.	32/6	26/–	6½	6½	31/3	+⅛	4 3 2
Ord.	83/3	53/3	20	20	77/–	..	5 4 0
Greenwood & Batley	25/6	20/–	15	15	20/–	..	13 0 0
Hall Telephone (10/–)	18/6	8/9	15	10	11/3	..	8 18 0
Henley's (5/–)	21/6	12/6	20	20	20/–	+⅛	5 0 0
4½% Pref.	21/2	20/6	4½	4½	21/3	..	4 4 8
Hopkinsons	46/9	32/6	12½	15	38/3	..	7 16 10
India-Rubber Pref.	21/–	19/6	5½	5½	20/–	..	5 10 0
Intl. Combustion	121/3	70/–	32½	32½	4½	..	7 17 9
J. Lucas	60/6	40/–	15	15	51/3	+6d.	5 17 0
Johnson & Phillips	50/9	32/6	12½	15	45/–	..	6 13 4
Lancashire Dynamo	59/9	47/6	25	20	47/6	..	8 8 5
Laurence Scott (5/–)	11/–	6/–	15	15	7/–	..	10 14 2
London Elec. Wire	25/6	20/–	7½	7½	22/6	..	6 13 4
Mather & Platt	46/6	30/–	13½	10	33/–	−1/–	6 1 3
Metropolitan Elec. Cable Pf.	22/–	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	80/–	+½	5 0 0
Pye Deferred (5/–)	9/–	6/9	25	25	10/0	..	14 5 8
Revo (10/–)	20/9	11/6	17½	5	17/6	..	2 17 6
Reyrolle	60/6	41/–	12½	12½	46/3	..	5 8 2
Siemens Ord.	23/9	15/6	7½	7½	18/9	+½	8 0 0
Strand Elec. (5/–)	2/3	9d.	4	2	1/9	..	5 14 4
S. Smith (1/–)	8/–	3/6	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/-)	11/9	5/6	20	10	7/6	..	6 13 4
Telegraph Condenser (10/–)	8/9	6/3	5	..	7/6	..	—
Telegraph Construction	42/6	29/–	10	10	35/–	..	5 14 6
Telephone Mfg. (5/–)	9/–	5/–	9	9	7/–	..	6 8 7
Tube Investments	96/9	59/–	23¾	23¾	91/3	−⅛	5 5 0
Vactric (5/–)	3/6	2/–	4	Nil	2/3	..	—
Vickers (10/–)	22/–	9/6	10	10	15/3	+3d.	6 11 4
Ward & Goldstone (5/–)	19/9	12/6	20	20	13/9	..	7 5 6
Westinghouse Brake	46/–	30/6	17½	10	40/–	..	5 0 0
Walsall Conduits (4/–)	26/6	17/6	55	55	26/3	+½	8 7 8
West, Allen (5/–)	7/–	3/–	7½	10	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

YUGOSLAVIA'S ELECTRICAL TRADE

British Share Not Maintained

IN 1939 the electrical import trade of Yugoslavia was fairly well maintained. The total value was 176,211,000 dinar compared with 180,683,000 dinar in 1938. The decline was mainly in power plant and some switchgear, while a drop in telephone and telegraph material was made up by an increase in radio goods. At the same time the trade in accumulators showed an advance.

	1939 Dinar (000)	Inc. or dec. on 1933 Dinar (000)
Dynamos, alternators and motors, 500 to 3,000 kg.—		
Total	8,168	− 3,338
From Hungary	583	− 63
„ Germany	6,006	+ 1,277
„ Great Britain	155	− 162
„ Czechoslovakia	697	+ 222
Over 3,000 kg.—		
Total	3,766	− 1,029
From Great Britain	114	− 307
„ Germany	1,837	+ 801
„ United States	480	+ 480
„ Czechoslovakia	515	+ 174
Under 500 kg.—		
Total	21,950	− 1,353
From Hungary	1,387	− 464
„ Great Britain	576	+ 237
„ Germany	15,352	+ 5,357
„ Czechoslovakia	2,966	+ 649
Transformers, up to 1,500 kg.—		
Total	6,632	+ 480
From Hungary	674	+ 313
„ Italy	288	+ 241
„ Germany	4,973	+ 1,107
Over 1,500 kg.—		
Total	3,313	− 38
From Hungary	509	− 17
„ Great Britain	122	+ 122
„ Germany	1,893	+ 643
„ Switzerland	610	+ 116
Condensers and accumulators—		
Total	3,868	+ 2,579
From Great Britain	98	—
„ Germany	552	− 15
„ Poland	3,044	+ 3,044
Electrodes for accumulators—		
Total	1,125	− 98
From Hungary	179	− 484
„ Germany	918	+ 463
Electrodes for furnaces—		
Total (mainly from Germany)	6,995	+ 246

Germany continued to obtain the bulk of the business, and the United Kingdom failed to hold the improved position she gained in 1937. The accompanying table is based on the recently issued Yugoslav foreign trade returns, notes of increases or decreases on 1938 having been added. It will be seen that a number of countries compete in the trade.

	1939 Dinar (000)	Inc. or dec. on 1938 Dinar (000)
Telegraph and telephone apparatus—		
Total	7,668	− 6,925
From Sweden	271	+ 199
„ Belgium	751	− 201
„ Germany	6,314	− 5,501
Signalling and bell apparatus—		
Total (mainly from Germany)	711	+ 190
Meters and measuring instruments—		
Total	6,926	+ 312
From Hungary	653	− 2
„ Germany	5,121	+ 975
„ Switzerland	1,036	− 267
Switches and starters for small motors for fans, etc.—		
Total	2,053	− 3,020
From Italy	102	+ 46
„ Germany	1,378	− 1,624
„ Sweden	491	− 458
Cookers, irons, heaters, etc.—		
Total	2,090	+ 102
From Czechoslovakia	88	− 43
„ Germany	1,840	+ 493
Radio-telephone apparatus and parts—		
Total	38,613	+ 7,260
From Hungary	2,424	− 714
„ Germany	21,168	+ 9,848
„ Holland	12,555	+ 5,018
„ Great Britain	242	− 656
„ United States	629	− 64
„ Sweden	303	− 173
Radio-telegraph apparatus and parts—		
Total	766	+ 684
From Great Britain	45	+ 32
„ Germany	635	+ 596
High-voltage circuit breakers, switches, starters, resistances and similar apparatus—		
Under 20 kg.—		
Total	405	− 581
From Germany	292	− 523

Last year Yugoslav foreign trade as a whole showed a large favourable commodity balance, with Germany and Italy dominating both the import and export market. The Axis has been a ready purchaser of the Yugoslav surplus of copper, lead, bauxite, timber, hemp and various foodstuffs. The value of the dinar in 1939 varied between 160 and 215 to the £1.

	1939 Dinar (000)	Inc. or dec. on 1938 Dinar (000)
From Switzerland	57	+ 2
From 20 to 100 kg.—		
Total	1,781	− 306
From Sweden	157	+ 70
„ Germany	1,200	− 154
„ Switzerland	94	− 14
„ Great Britain	87	+ 44
From 100 to 500 kg.—		
Total	1,976	− 800
From Switzerland	206	− 190
„ Germany	1,181	− 157
„ Sweden	187	− 117
Over 500 kg.—		
Total	882	− 504
From Germany	592	− 251
„ Switzerland	220	+ 24
Other switchgear, switchboards, etc.—		
Total	27,689	+ 1,671
From Great Britain	1,172	+ 679
„ Germany	21,667	+ 3,882
„ United States	1,004	+ 87
Bulbs for torches—		
Total	1,001	+ 524
From Great Britain	165	+ 165
„ Germany	739	+ 352
Other incandescent lamp bulbs—		
Total	4,229	− 2,389
From Germany	1,993	− 29
„ Hungary	1,922	− 2,060
Batteries—		
Total	456	+ 35
From Germany	336	+ 153
„ United States	44	− 100
Underground and submarine cables—		
Total	12,500	+ 703
From Germany	9,680	+ 2,282
„ Italy	727	− 1,488
Other electrical cables and wire—		
Total	1,628	− 1,272
From Italy	128	+ 10
„ Great Britain	61	− 79
„ Germany	1,332	− 733

Turkish Electrical Imports

New Commercial Arrangements with Great Britain

THE electrical import trade of Turkey, after a marked upward movement in 1938, declined in 1939, particularly in the machinery groups. Telephone material and insulated wire and cable were the only important items showing increases. In cables and wires Italy's competition was noticeable. Otherwise most of the trade went to Germany.

	1939 £T. (000)	Inc. or dec. on 1938 £T. (000)
Copper wire and cable, insulated with rubber, etc.—		
Total	210	+ 40
From Germany	122	+ 30
„ United Kingdom	13	− 11
„ Italy	63	+ 23
Copper wire and cable, covered with silk—		
Total	19	+ 14
From Germany	5	+ 1
„ United Kingdom	11	+ 11
Copper wire and cable, armoured types—		
Total	588	+ 87
From Germany	432	+ 62
„ United Kingdom	35	− 45
„ Italy	90	+ 60
Incandescent lamps—		
Total	395	− 72
From Germany	105	− 110
„ Holland	56	+ 20
„ Italy	47	+ 35
„ Hungary	120	+ 34
Telegraph material—		
Total	52	+ 9
From Germany	25	+ 4
„ Hungary	15	− 2

The accompanying table, which is based on the official Turkish foreign trade returns, shows the values of the principal electrical goods imported in 1939, with notes of increases or decreases on 1938. The average sterling rate in 1939 was £T5½ = £1.

New commercial arrangements have been made between the British and Turkish Governments. They provide for the supply to the latter of heavy goods from the United Kingdom and the Empire and will to a large extent be initiated by the United Kingdom Commercial Corporation. During the first seven months of 1940 Italy was an active trader in the Turkish market. The United States came next, while Germany and the United Kingdom were close together as the third largest importers.

	1939 £T. (000)	Inc. or dec. on 1938 £T. (000)
Telephone material—		
Total	290	+ 43
From Germany	47	− 38
„ Sweden	83	− 14
Radio telephone transmitters, receivers and parts—		
Total	1,147	− 25
From Germany	352	+ 60
„ Holland	330	+ 102
„ United Kingdom	46	− 177
„ United States	290	− 38
Dynamos, motors, transformers, convertors, etc., 10 kg. and under—		
Total	250	− 153
From United Kingdom	9	− 46
„ Germany	154	− 67
„ United States	54	− 22
Dynamos, motors, transformers, convertors, etc., 10-50 kg.		
Total	128	− 198
From United Kingdom	4	− 41
„ Germany	107	− 91
„ United States	9	− 40
Dynamos, motors, transformers, convertors, etc., 50-1,000 kg.		
Total	369	− 486
From United Kingdom	36	− 162
„ Germany	286	− 171
Dynamos, motors, transformers, convertors, etc., 1,000-2,000 kg.—		
Total	84	− 165
From United Kingdom	35	− 31
„ Germany	43	− 78
Dynamos, motors, transformers, convertors, etc., 2,000-5,000 kg.		
Total	63	− 182
From United Kingdom	13	− 139
„ Germany	10	− 41
„ Hungary	17	+ 5
Dynamos, motors, transformers, convertors, etc., over 5,000 kg.—		
Total	153	− 303
From United Kingdom	65	− 305
„ Germany	88	+ 17
Accumulators and cells—		
Total	128	+ 8
From Germany	75	+ 3
„ United States	—	—
Dry cells—		
Total	194	− 64
From Germany	167	− 79
„ United States	18	+ 13

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parenthesis. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Millbank, Westminster, London, S.W.1

Australia. — BRISBANE. — February 6th. City Electric Light Co., Ltd. 415-V, three-phase, 50-cycle, indoor-type, metal-clad switchgear. (T.23623/40.)*

Eire.—LEITRIM.—February 7th. Board of Health and Public Assistance. Supply, delivery, and erection of three pumping units for the Carrick-on-Shannon sewerage scheme, including electric motors, and automatic switchgear. Documents may be obtained from P. H. McCarthy & Son, engineers, 26, Lower Leeson Street, Dublin, or P. J. Haugh, county engineer, The Courthouse, Carrick - on - Shannon. (Deposit: £5 5s.).

London. — FINSBURY. — January 30th. Borough Council. Two booster pumps for lifting the water supply through service tanks at two baths establishments. Particulars from the Baths Superintendent, Merlin Street Baths, London, W.C.1.

New Zealand. — WELLINGTON. — January 29th. Post and Telegraph Department. Condensers, conductor cords and headbands. (T.23413/40.)*

Post and Telegraphs Department. February 6th. Single-core power cable. (T.23550/40.)*

South Africa.—PRETORIA.—February 12th, City Council. One or, alternatively two, 18,750-kW turbo-alternators and exciters. with condensing and auxiliary plant. (January 10th.)

January 30th. Union Tender & Supplies Board. 200 lighting protectors. (T.23336/40.)*

February 3rd. 73 outdoor-type transformers ranging from 50 to 2,000 kVA. (T.23639/40.)*

CAPE TOWN.—January 28th. Electricity Department. Three oil-immersed single phase 270-kVA transformers. (T.23173/40.)*

January 29th. Air conditioning plant. (T.23387/40.)*

PORT ELIZABETH.—March 13th. Municipality. One battery driven tower wagon and one battery driven van. (T.15013/41.)*

Electric lamps and cable conduit. (T.15014/41.)*

Southern Rhodesia.—SALISBURY.—March 10th. City Electricity Department. 374 meters of various types. (T.23645/40.)*

Orders Placed

Basingstoke.—Town Council. Accepted. 150-kVA transformer (£133).—Electric Construction Co.

Bath.—Town Council. Accepted. Work in connection with the lighting of shelters (£171).—H. L. Bush & Co.

Belfast.—Harbour Board. Accepted. Two electrically-driven sewage pumping plants.—Pulsometer Engineering Co.

Birkenhead.—Electricity Committee. Accepted for six months:—E.h.v. and l.v. cables.—Aberdare Cables; Britannic Electric Cable & Construction Co.; and Scottish Cables.

Rubber-insulated cables.—Durham Cables; William Geipel; and Mersey Cable Works.

Meters.—British Electric Meters; Ferranti; Landis & Gyr; Sangamo Weston; Measurement; Venner Time Switches; and Smith Meters.

Bournemouth. — Emergency Committee. Accepted. Petters ¾-kW generator, battery and lighting points at report centre (£330).—Aish & Co.

Heston and Isleworth.—Town Council. Recommended. Two batteries for refuse collection vehicles (£353).—Young Accumulator Co.

Newport (I.-o-W.).—Water Committee. Accepted. Electrically - driven booster pumps (£594).—Harland Engineering Co.

Manchester.—Electricity Committee. Accepted. Water cooling tower.—Davenport Engineering Co.

Highways Committee.—Accepted. Pedestrian signals at Cheetham.—Siemens & General Electric Railway Signal Co.

Salford.—Light Committee. Recommended. 36 electric wash boilers (£4 2s. 8d. each).—S. Simister. 60 electric cookers (£16 8s. each).—Elexcel, Ltd.

Sheffield.—Town Council. Accepted. Supply and erection of one 5,000-kVA auxiliary transformer (£2,751).—Metropolitan-Vickers Electrical Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Communal kitchens and feeding centres, for T.C.; H. Sanderson, borough surveyor, Town hall.

Ancoats.—Engineering works, Darlington Street, Clark Street, Union Street and Vincent Street; G. Brady & Co., Ltd., New Islington Works, Ancoats, Manchester.

Batley.—Completion of four shops in Commercial Street by T.C.; T. Mossop, borough surveyor, Town Hall.

Birmingham.—A.R.P. schemes (£200,000); city engineer.

Blackburn.—Completion of two bays of the Cathedral Extension for Diocesan Council; T. Croft & Son, Ltd., builders, Holme Slack, Preston.

Bridgnorth.—Restoration of Town Hall, for T.C.; borough engineer, Municipal Offices, Bridgnorth.

Burnley. — Gymnasium, Holy Trinity Church Schools, for E.C. (£2,400); J. L. Beckett, borough engineer, Town Hall.

Burnage.—Church, Burnage Lane for Bishop of Salford; W. Ellis, architect, Union Bank Chambers, Hardshaw Street, St. Helens.

Clitheroe.—Alterations, Agricultural Hall, King Street; Preston Farmers, Ltd.

Coventry.—Alterations, etc., Police Headquarters, St. Mary's Street, for T.C.; D. E. E. Gibson, city architect, 1a, Warwick Row.

Dewsbury.—Garage workshop re-erection; J. Kaye & Co., Mill Street West.

Extensions to engine room at Laundry, Ravensthorpe; Hinchliffe's Victoria Laundry (Ravensthorpe), Ltd., Sackville Street.

Jarrow.—Adaptation of premises as maternity hospital, for T.C.; J. S. Weir, borough engineer.

Kettering.—Leather store, Alfred Street; W. E. Bridges, Alfred Street.

Leigh.—Warehouse, Ellesmere Street; Albion Builders' Supplies, Ltd., Canal Wharf.

Long Clawson.—Assembly hall; Building Committee, Village Hall.

Macclesfield.—Maternity block, West Park Hospital, for Health Committee; M. Tetlow, borough architect, Pear Tree House.

Manchester.—Offices and service station, Dickenson Road, Rusholme; Hoover, Ltd., Perivale, Greenford.

Additions to works; H. Burke, civil engineer, Green Lane, Chorlton-on-Medlock.

Middlesbrough. Warehouse for J. Meredith, Union Street; Ketching & Co., 21, Albert Road, Middlesbrough, architects.

Morley.—Alterations and improvements, Malt Shovel Inn, Drighlington; Stretton's Derby Brewery Co., Ltd.

Newcastle-on-Tyne.—Shed and warehouse for Packers, Ltd., confectionery manufacturers; R. W. Hutchinson, North Street, Newcastle, contractor.

Alterations to business premises, 2x, Pudding Chare; Wilson & Wilson, architects, 128, Grainger Street, Newcastle.

Alterations to business premises, 17-19, High Bridge, for J. Pane; C. Solomon, architect, 187, Osborne Road, Newcastle.

Newcastle (Staffs.)—Communal feeding centres at Schools for T.C.; A. Cotton, borough surveyor, Municipal Buildings.

North Riding.—New Ormesby school, and additional accommodation for domestic science and handicrafts at Easingwold; J. W. White, county architect, County Hall, Northallerton.

Nottingham. — Houses (150), Carlton; Trent Concrete, Ltd.; Colwich, Netherfield.

Rotherham.—School canteen at Park Street Council School, for E.C.; V. Turner, borough engineer, Town Hall.

Salford.—Works extensions, Pendleton. J. Hodgkinson (Salford), Ltd., engineers, Salford.

Scarborough.—124 shelters (£12,585), and proposed deep shelters scheme, for T.C.; borough engineer, Town Hall.

Skelmersdale.—Public shelters (3,600 persons), for U.D.C.; surveyor, Council Offices, Town Hall, Skelmersdale.

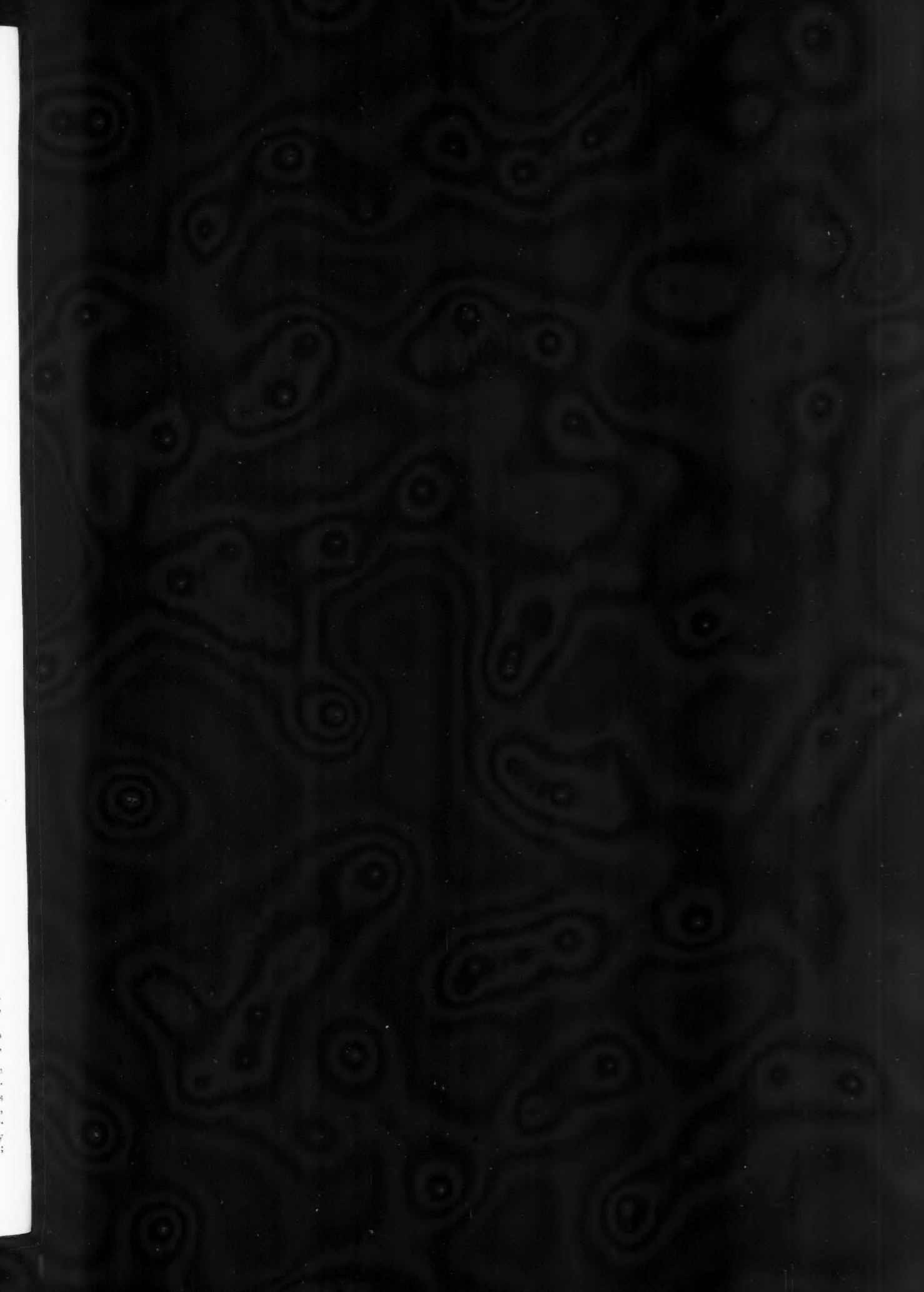
Stafford.—Conversion of No. 7, St. Mary's Grove, for Council offices; R.D.C. surveyor.

Staveley.—Feeding communal centre and kitchen, for U.D.C.; J. B. McGaw, surveyor, Council Offices.

Stoke-on-Trent.—Egg testing and receiving station, Corporation Street; E. Shaw, manager and secretary, Oak House, Dayhills, Hilderstone.

Wallsend-on-Tyne. — Blacksmith's shop and offices; R. N. Dodds, blacksmith, Hadrian Road, Wallsend.

Warehouse building for R. Hood, Haggie & Sons, Ltd., ropemakers; R. Frail, manager.

West Auckland (Co. Durham).—Extensions to factory; E. M. Lawson, Barras Buildings, Barras Bridge, Newcastle-on-Tyne, architect.

Whitworth (near Rochdale).—Community feeding centre and kitchen, for U.D.C.; G. V. Law, surveyor, Council Offices.